Tesla – Westinghouse

Correspondences

Edited by Jeff Behary

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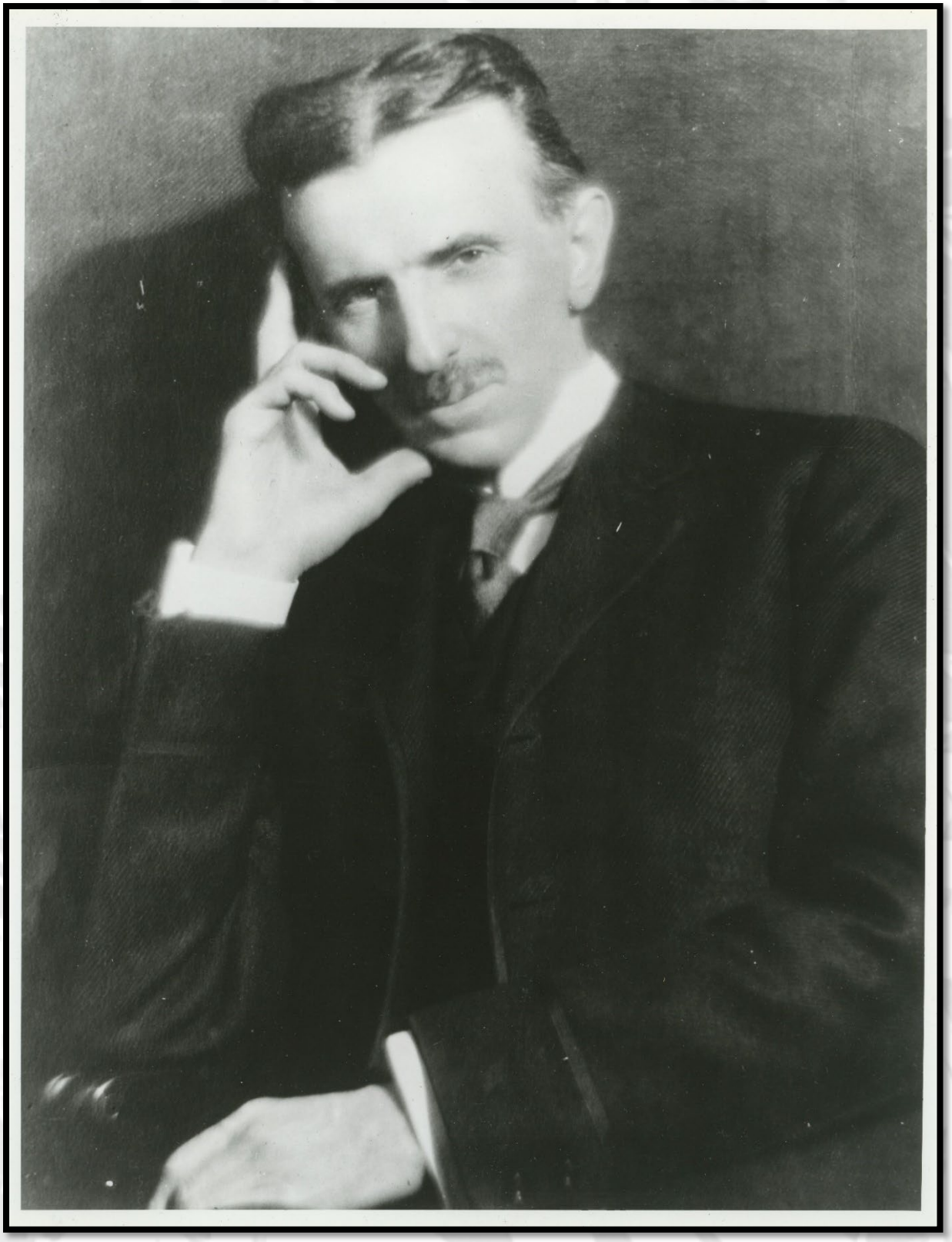


“Portrait of Nikola Tesla”, George Westinghouse Museum Collection, c.1864-2007, MSS 920, Detre Library and Archives, Senator John Heinz History Center

The following pages were compiled from materials formerly collected by Leland I. Anderson, originally donated to the Western Pennsylvania Historical Society, now known as the Senator John Heinz History Center in Pittsburgh, PA.

They are part of the ***Leland Anderson Collection on Nikola Tesla*** – more than 49.5 linear feet (49 boxes)

"Leland Anderson was a writer and researcher who is the author of a number of published works on the electrical engineer and inventor Nikola Tesla. Tesla, who worked for the Westinghouse Electric and Manufacturing Company in 1888, was known for his work on the alternating current system, radio communication, and X-ray technology.

Beginning in the 1940s and continuing over the next 50 years, Anderson compiled a large collection of research materials documenting the life and work of Tesla. " (taken from historicpittsburgh.org website)

Most of the letters transcribed in this book were acquired by Leland from Library of Congress microfilms of correspondence in the archives of the Nikola Tesla Museum in Belgrade. Typos and grammatical errors in the original texts were left unaltered. In addition, there are a series of letters transcribed by William Terbo and I which were found in a file cabinet at Niagara Falls written between Nikola Tesla and Edward Dean Adams and pertain to the conversations leading to the final decision to place Westinghouse generators at that famous location.

Left: James Hardesty, Leland I. Anderson, and William C. Wysock standing in front of the "extra" coil used in the Model 13M Magnifying Tesla Coil. Right: Tesla Technology Research Model 13M Magnifying Tesla Coil producing ca. 56 ft. discharges. (Both images are from Bill Wysock's archive)

The next ten pages represent the scope of The Leland Anderson Collection on Nikola Tesla, taken from the Senator John Heinz History Center. I present it here as unedited in-full as not to diminish the vast scope of Lee's work, which was unique to the world in that the first-hand knowledge and materials he had obtained in his lifetime, starting in the 1940s, could never be replicated outside of the time period in which he lived. He was literally the right person in the right place at the right time to do this work, and had he not done the work that he did much first-hand knowledge regarding Tesla would have been permanently lost:

History

Leland Anderson

Leland I. Anderson (b. 1928) is a writer and researcher who is the author of a number of published works on the electrical engineer and inventor Nikola Tesla. Anderson, an electrical engineer, technical writer, and former manager of the Minnesota State Historical Society, took up an interest in Tesla during high school in the 1940s, shortly after Tesla's death. Over the course of the next 50 years, Anderson compiled a large collection of materials documenting Tesla's life, work, inventions, technical theories, and more recent work-based Tesla's ideas. Anderson founded the Tesla Society, and was editor of its newsletter, Tesliana, beginning in the 1950s. In 1956, he and John T. Ratzlaff published an extensive bibliography of over 3,000 citations of writings by or about Tesla, which was subsequently updated over the following decades. Additionally, Anderson has written and edited numerous books on Tesla and his work.

Nikola Tesla

Nikola Tesla was an electrical engineer and inventor who experimented in electricity, magnetism, and radio waves and is best known for developing the alternating current (AC) electrical supply system and the polyphase induction motor Recognized today as a Serbian-American, Tesla was born in 1856 in Smiljan, Lika, which today is in modern-day Croatia. After completing his education in Prague in 1880, he worked as chief electrician for a telephone company in Budapest, and soon after was employed for the Continental Edison Company in Paris.

Tesla accepted a position working with Thomas Edison in America in 1884, although he resigned after only a year following a payment dispute with Edison. With the backing of several investors the short-lived Tesla Electric Light and Manufacturing Company was formed in 1885, followed by the Tesla Electric Company in the spring of 1887. In 1888, after hearing of a public presentation Tesla made proposing his alternate-current motor and transformers, George Westinghouse licensed the patents for Tesla's polyphase induction motor, and several of his transformer's designs. Tesla was subsequently hired on a year-long contract to continue his AC designs and act as a consultant for Westinghouse Electric and Manufacturing Company's labs in Pittsburgh, Pa. During the year Tesla lived and worked in Pittsburgh, he furthered his AC designs, actually using the system to power some of the city's streetcars for a short time. Nikola Tesla became a naturalized American citizen in 1891.

Tesla assisted Westinghouse in powering the 1893 Columbian Exposition in Chicago, demonstrating to the public the viability of large-scale alternating current power. He experimented with X-ray technology and wireless radio development, and participated in several industrial and scientific organizations including serving as vice president of the American Institute of Electrical Engineers between 1892 and 1894. In 1899, Tesla began a year-long series of high-voltage electricity experiments in Colorado Springs, Co. Soon after his Colorado experiments, which gained national publicity, he received funding to build a large transmission tower on Long Island, New York. Wardenclyffe Tower, which was never completed, was intended by Tesla to conduct wireless communication and wireless electrical transmission tests. Tesla's research and experimental interests late in his life revolved around aviation, interstellar power sources, extraterrestrial communication, weaponized energy, electrotherapeutics, and radio-controlled. While he became more reclusive has he aged, Tesla earned roughly 300 patents internationally during his lifetime, including several bearing his name, such as the Tesla coil and Tesla turbine. Nikola Tesla died in the New Yorker hotel, where he had long since taken up resident, in 1943.

Scope and Content Notes

The Leland Anderson Collection on Nikola Tesla documents the life and work of engineer and inventor Nikola Tesla. The collection primarily contains secondary research materials compiled by Anderson over the course of 50 years, and includes photocopied contextual materials on Tesla's life and times from research institutions; Anderson's own work; topical materials covering Tesla's various fields of work and experimentation; biographical material on Tesla's contemporaries; journal and scholarly articles on Tesla's inventions and patents; journals, newspapers, and publications on Tesla and his work; and audio/visual materials including photographs, negatives, VHS tapes, cassette tapes, 35 mm slides, and microfilm. The collection contains 49 boxes and has been arranged into 8 series: I. Contextual/Biographical about Tesla; II. Leland Anderson's Research; III. Topical; IV. Biographical Materials, Tesla's Contemporaries; V. Tesla's Patents and Inventions; VI. Scholars Files; VII. Journals and Publications; VIII. Audio/Materials.

Series I. Contextual / Biographical about Tesla

Series one contains contextual material on the life of Nikola Tesla, primarily contained in secondary publications concerning different facets of his life and work.

Box 1 Scrapbooks created by Leland Anderson containing newspaper clippings, articles, and photocopied materials about Tesla, photocopies of letters to and from Tesla concerning his work and discoveries (1900s-1940s), and articles on Tesla and his contemporaries.

Box 2 2 Scrapbooks of published articles concerning Tesla's theories and works, from 1943 through 1961, and the 1970s. There are also three folders of assorted biographical materials concerning Tesla, including correspondence to and from Tesla and copies of agreements with Westinghouse.

Box 3 3 Scrapbooks containing newspaper clippings, articles, and assorted photocopied biographical materials

Box 4 Biographical material on Tesla, primarily copies and chapter excerpts from different works. There is an original manuscript of John Jay O'Neil's biography on Tesla, Prodigal Genius.

Box 5 Contextual materials about the life and times of Nikola Tesla including writings about him, articles about his life, interests, and ideas, as well as theories he was connected with.

Box 6 Contextual information, primarily copies of authors' papers, news clippings, magazines, and research concerning topics such as Tesla's death, Tesla and extra-terrestrial communication, Tesla's family, his patron saint, spirituality, social acquaintances, and musings on his personal philosophy.

Box 7 Photocopied materials featuring Tesla's writings for various publications and addresses to the New York Academy of Science, NY Electrical Society, and others. There is also photocopied correspondence with colleagues and relatives (1880-1942) that was translated by staff from the Tesla Museum in Belgrade. There is a box level inventory inside this box.

Series II. Leland Anderson's Research

Series two consists of copies of archival and library materials from a number of institutions, as well as published materials on Tesla's life or his work, which were used by Anderson in compiling his writings about the man.

Box 8 Primarily photocopied archives materials, including copies from the Marie Scherff Collections at Columbia University, all on Tesla's life and work. Marie Scherff's father, George Scherff, was Tesla's trusted assistant. Box 8 also includes Library of Congress (LOC) copies of correspondence between Tesla and Mark Twain (1892-1910), Westinghouse Electric and Manufacturing Company (1888-1899), and John Pierpont Morgan (1907-1943).

Box 9 Photocopied archival material, primarily from the LOC, of correspondence between the Westinghouse Company, Tesla, George Scherff, and others. There is additional material from other institutions.

Box 10 Primarily contains copies of Columbia University correspondence between Tesla and Robert Underwood Johnson, or between Johnson and others concerning Tesla. Johnson was an author, editor of the Century Magazine, and United States diplomat.

Box 11 Bibliography, indexes, and articles Anderson and Ratzlaff used to compile their bibliography.

Box 12 Articles and reports written or edited by Anderson on Tesla's theories, inventions, and lectures; binder of some primary letters, with 2 possibly written by Tesla, and others concerning him. There are several portfolios containing Anderson's views on public opinions about Tesla and his work.

Box 13 Research materials used in Anderson's writing and scholarship, including photocopies from books, correspondence with other experts and institutions, FOIA requests, and materials from the Tesla Museum in Belgrade, Serbia.

Series III. Topical

Series three contains topical materials relating to Tesla including radio wave development and Tesla's role in wireless experimentation, and international engineers' conference bearing his name, AC/DC current war, Niagara Falls, Tesla coils, government materials concerning Tesla, and the Wardenclyffe Tower.

Subseries A. Radio History

Box 14 Historical developments in radio history including articles related to Tesla's contributions to wireless radio transmission. There are editions of the Antique Wireless Association (AWA) review (1980s-1990). There are copies of Tesla's correspondence with Benjamin F. Miessner.

Box 15 Materials concerning the history of radio including Mid-Atlantic Antique Radio Club newsletters (1980s-1990s), proceedings from the Institute of Radio Engineers (1950s- 1960s), and articles from early 20th century.

Box 16 Materials concerning the history of radio including historical context for radio and wireless transmission development. This box also includes Tesla Symposia materials, including commemorative and scholarly articles (1956-1990s).

Subseries B. Tesla Symposia

*The Tesla Symposia is an international technical engineers conference, usually held in conjunction with the anniversary of Tesla's birthday.

Box 16 Box 16 also includes Tesla Symposia materials, including commemorative and scholarly articles (1956-1990s).

Box 17 Symposia materials, proceedings, commemorations 1970s-1990s; Symposia lectures 1990s.

Subseries C. AC/DC Controversy, Niagara Falls

Box 18 Select articles covering and describing the AC/DC controversy involving Tesla, Westinghouse, and Edison, as well as the development of hydroelectric power at Niagara Falls.

Subseries D. Legal Materials

Box 19 Legal materials and court proceedings including several of Tesla's patent battles, as well as other relevant cases, some dealing with Marconi Wireless Telegraph Co.; requests and correspondence of Leland Anderson to various repositories for said information.

Subseries E. Tesla Coils

Box 20 Tesla's Coil Builders Association (1982-1998); topographical maps of Colorado Springs and area (1995); general information about Tesla's Colorado Springs experiments.

Box 21 Materials on Tesla coils, including articles, scholarly papers, and bulletins on Tesla Coils (1890-1980s).

Subseries F. Government Materials

Box 22 Government files: FBI files obtained by Arthur B. Keyes through FOIA requests (1943- 1949); correspondence of division of Investigation and Research (1940s); Federal Agency records on Nikola Tesla (1934-1981).

Subseries G. Wardenclyffe Tower

Box 23 Journal articles and other materials on Tesla's Wardenclyffe Tower.

Series IV. Biographical Materials on Tesla's Contemporaries

Series four is comprised of secondary contextual material focused on engineers and scientists of Tesla's time, as well as person who have done research on Tesla, or have conducted more recent experimentation based on his theories and work.

Box 24 Photocopies of research, correspondence of, and biographical materials on prominent scientists and engineers, primarily Tesla's contemporaries, including George Scherff, Steinmetz, and Westinghouse (1890s-1990s).

Box 25 A-H: Biography files of prominent scientists and engineers including Tesla's contemporaries, as well as figures/persons that have researched and studied Tesla (1900s).

Box 26 G-R: Biography files of prominent scientists and engineers including Tesla's contemporaries, as well as figures/persons that have researched and studied Tesla (1900s).

Box 27 Author extracts from works on or about Tesla; photocopied materials extracted from authors works about Tesla or work based on his theories.

Series V. Tesla's patents and inventions

Series five focus on the over 300 patents Tesla received during his life time, comprised of secondary materials on the subject.

Box 28 Photocopied materials removed from published materials specifically on Tesla's inventions and discoveries such as the electric motor turbines, and wireless radio waves. There is one folder of photocopies of Tesla's own notes (1920s) concerning ether and gravity.

Box 29 Articles, scholarly papers, and reflections on Tesla's inventions, including pumps, turbines, and other machinery. Included are patent materials, Leland Anderson's correspondence with other Tesla scholars about patents and inventions (1880s-1980s).

Box 30 Patent and invention materials, some of which is from NARA, as well as more recent research materials and studies based on Tesla's patents.

Series VI. Scholars Files

Series six contains analytical and research-based materials produced Professor Warren Rice and Dr. James Corum based on Tesla's work and theories.

Subseries A. Professor Warren Rice

Professor Warren Rice (b.1925-d.2009) was a mechanical engineer at Arizona State University

Box 31 Professor Warren Rice Papers, A-H; college papers and dissertations related to Tesla's theories and work.

Box 32 W. Rice Papers, H-Z. Box 32 also includes J.R. Johler reports and papers on radio waves produced by the National Bureau of Standards; research, papers, some correspondence of James R. Wait, an electromagnetic scientist and educator.

Subseries B. Dr. James F. Corum

Dr. James F. Corum is a highly distinguished electrical and electronic engineer, and is a member of the Tesla Memorial Society of New York.

Box 33 Dr. James F. Corum papers including technical and scholarly papers on Tesla; as well as 6 cassette tapes of Corum's speeches to the International Tesla Society, Inc.

Box 34 James F. Corum Papers including technical and scholarly articles and analyses of Tesla's work (1930-1990).

Series VII. Journals and Publications

Series seven contains numerous scientific and engineering publications and journals containing articles about Tesla, his work, or subsequent work and research based in his theories. Several publications are produced by Tesla-centered organizations.

Box 35 Foreign Language publications, primarily the American Srbobran, the newspaper produced by the Serb National Federation. There is also a serial titled Tesla, published in Serbian.

Box 36 A-E: Scientific and engineering periodicals containing articles about Tesla, his work, or research based on his theories. Primarily a variety of copies of newspaper articles.

Box 37 E: Scientific and engineering periodicals containing articles about Tesla, his work, or research based on his theories, including: Electrical Engineers (1888, 1890, and 1910s), Electrical World (1889-1899, 1956-1990).

Box 38 E-M: Scientific and engineering periodicals containing articles about Tesla, his work, or research based on his theories, including various electrical and electronic journals.

Box 39 N-P: Scientific and engineering periodicals containing articles about Tesla, his work, or research based on his theories, including: Regular Mechanics, Popular Science, copies of New York Times editions (1890s-1990s).

Box 40 Q-S: Scientific and engineering periodicals containing articles about Tesla, his work, or research based on his theories, including Practical Electrics (1921-1925), Radio Electronics (1940s-1960s), Science and Inventions (1920s-1930s).

Box 41 S-Y: Scientific and engineering periodicals containing articles about Tesla, his work, or research based on his theories, including The Teslian, The Tesla Journal, a 1931 Time edition covering Tesla, Westinghouse publications, and the Scientific American (1892- 1915).

Box 42 Bound copies of Electrical World (1891); On May 1892 edition featuring the full text of Tesla's London lecture; Illustrated Electrical Review editions (1890s); Scientific American (1900s); all containing articles or references to Tesla's works.

Box 43 American Srbobran newspapers on Tesla (1911-1945); assorted other serials.

Box 44 Photocopies of newspaper articles, feature magazine articles, concerning Tesla, his work, inventions, discoveries, and theories from 1890s-1910s

Box 45 Contains Electrical Review editions from 1890s-1900s; assorted publications with stories on Tesla.

Series VIII. Audio/Visual Materials

Series eight contains the audio and visual materials within the collection, including photographic reproductions of Tesla and his work, VHS tapes containing Tesla features and interviews with Leland Anderson, Tesla correspondence from the LOC on microfilm, and cassette tapes with audio recording of lectures and speeches concerning Tesla and his work.

Box 45 Box 45 also contains several larger photographs of Wardenclyffe tower, machinery, and turbines. There are also 2 images of the rock band Tesla.

Box 46 Photographs of Tesla, machinery, turbines, Wardenclyffe, Tesla with friends and associates, Tesla scientific experiments, electromagnetic experiments Leland Anderson was involved with. The photographs concerning Tesla are primarily reproductions or copies.

Box 47 VHS Tapes (1990s): National Tesla Productions, Inc., feature programs on Tesla and his works. Three Tapes contain a personal interview with Leland Anderson about his interest in Tesla and a history of Tesla's work.

Box 48 Microfilm (1888-1940s): Tesla correspondence on microfilm from Library of Congress, Tesla Museum, and Columbia University Library.

Box 49 Cassette Tapes: Scholars and scientists lectures, radio tributes to Tesla, 1990 lectures from Tesla Symposia. There are also a number of 35mm slides, containing images of Tesla materials and ephemera Leland Anderson photographed.

Preface

My introduction to Leland I. Anderson was not an easy process. I heard of Leland for years and owned several of his books, of which I held a particularly high regard and appreciation for. I started researching Nikola Tesla exactly 50 years after Leland. My own collection is known as the "Electrotherapy Museum", a name originally derived from collecting bizarre and eccentric "quack medical devices". In the mid-1990s the internet was something rather new and exciting, and my unusual hobby formed at the right place in the right time. I started to document a side of history that seemed to have vanished off the face of the Earth. In reality, it was more swept under the carpet – if it were nor for the fact that many of the devices were confiscated and burned in an effort to protect the public (rather than educating them).

As companies suspected of selling fraudulent medical devices were seized and assets confiscated on a one-by-one basis, a lot of history fell through the cracks of this process, or perhaps better phrased "resurfaced from the cracks" decades or even a half-century later. This included a vast plethora of early Tesla Coils sold for medical use. In documenting this side of history, books and literature about the various machines were much more difficult to find than the actual apparatus, and that fueled my quest to develop the world's largest archive of seemingly "underground" information.

Being in the 1990s, however, it was a most interesting time period for my activities on many levels. Alternative medicine was becoming very popular, and within a few years the same devices that I was documenting from the past (being sold in the backs of magazines as cure-alls) were now being sold again under the same guise only via the internet, preying on the public's fear and general distrust of the medical establishment, drug companies, etc. Typically, the machines were advertised with a wealth of conspiracy theories… and the fact that various institutions including the FDA and AMA were the ones originally confiscating and hiding the history just added the fuel to the fires making many of the endeavors of modern charlatans successful.

This said though, as I acquired more apparatus (well over 500 machines throughout the years) I saw that many of the devices had plausibly legitimate medical use either for dermatology, electro-

surgical use, diathermy, physical therapy or rehabilitation uses, or X-Rays. As with most history and controversial topics, the real truth is far from black and white, it's all rather grey: and I set off to transform the grey areas of the past into the colorful stories where all sides receive their due justice.

Not all of the branches of "electrotherapy" were relating to quackery, though many of the devices were marketed by charlatans and used by "irregular practitioners" (as they were referred to in the 1920s). Many of the same inventors who started off making medical apparatus ended up helping our government during the war effort and developing/pioneering wireless telegraphy, radio, and remote-control apparatus. Many of these same pioneers developed apparatus that one might argue had priority with the inventor Nikola Tesla. And this is where the history gets extremely interesting and convoluted at best: Tesla's laboratories produced few commercial products on their own.

Having a background as a machinist and metal worker, I started restoring and building reproductions of many of the machines and technologies I was experiencing, as I made every historic machine in my collection functional. It served for two purposes, to document a unique side of history and to also obtain the firsthand knowledge of how the apparatus originally functioned and relearning the processes used to create them – because nothing can be improved upon when not fully understood to begin with.

This is where my hobby and story take a drastic turn into something serious. In 2004 I spoke at a conference in Baltimore and was quickly embraced by a man named William Terbo. Little did I know at the moment that this man was the last blood-relative of inventor Nikola Tesla. We struck a friendship that grew closer with each year and lasted until he died in 2018. I was even supposed to handle the family estate, however, unfortunate circumstances beyond my control did not allow that to happen - which resulted in probably the second largest archive of Tesla materials in the United States getting scrapped. I have no words to describe the feelings of that situation other than pure anger and disbelief.

William was most interested in my work because I never tried to sell any of the apparatus as "quackery". It was solely an effort to understand and decipher the physics behind an entire industry which was not well-understood, not well-documented, and even more so mis-represented with the few attempts that had been made over the years (typically by people with extremist views, or questionable credentials).

My interest in Leland's work grew exponentially over the years as I began replicating Tesla's work, some of which went hand-in-hand with one of Leland's books "Nikola Tesla: Lecture Before The New York Academy of Sciences, April 6, 1897". To my surprise, none of my colleagues in the field, including William Terbo, would share with me Leland's contact information. (This included Bill Wysock and Jim Hardesty, two of my mentors, shown in the opening photo with Leland; and Harry Goldman, a fellow Tesla historian and collaborator). Finally, one day Harry disclosed to me the secret why: Leland had become legally blind, with a vision worse than 20/2000. They all assumed that he was better off not knowing me - knowing the fact he was unable to see the scope of my work.

In the years that followed, much to my surprise, it was Leland I. Anderson who reached out to me – something I never thought I would live to experience. Lee had left the Tesla scene, mainly in disgust of how Tesla was being portrayed by fanatics. Being a historian, there is nothing worse than people spreading false information. Unfortunately, with Tesla this started the year he died with his first biography "Prodigal Genius" by John Joseph O'Neill, and has grown ever-worse as more authors simply publish books paraphrasing the misinformation put out by the previous ones. The life of the one of the

Photographs of apparatus in Jeff Behary's "Electrotherapy Museum".

most historically significant visionaries and inventors has been reduced to little more than science fiction. I can understand why Leland left the scene…and this leads to how we (remotely) met.

There was a large chainmail of emails that I was (grudgingly) added to regarding the transmission of electrical energy wirelessly. I did not want any part of these discussions. Typically, they were made up of non-engineers without electrical or scientific backgrounds attempting to do what many will claim as impossible. I don't have – nor will pretend to have – the scientific and electrical engineering knowledge to even attempt to build a serious apparatus for wireless transmission of electrical energy through the natural media such as the earth or atmosphere. Of course, in my museum I often demonstrate wireless lighting but in a most inefficient manner for the thrill of letting visitors experience the idea… and also to understand the scope of the effectiveness based on the period apparatus I have functioning on display in contrast to the amount of electrical energy expended to do so.

After several weeks of emails, I finally had enough and responded to the entire list of people asking why they should expect to realize the last vision of the one of the greatest electrical pioneers on Earth when a majority of them cannot even build an efficient table-top Tesla Coil and have little to no understanding of the original high frequency work Tesla did in his early laboratories. This was followed by a request to no longer receive emails from any of them.

To my surprise, I was forwarded an email from a friend of Leland's named Steve Hinkley. Leland had responded to the group that I was "the only one of them that had my head screwed on straight", and that from this point forward I was the only person he would accept correspondences from. My initial response to Leland were the two very important words I wanted to convey to him all along: Thank you.

The exact response and emails that followed are below:

On Mar 10, 2012, at 5:12 PM, "Steve Hinkley" wrote:

Dear Mr. Behary,

I have been handling Lee Anderson's email for him since his eyesight makes it difficult for him to do it on his own. I receive his email, print it, and pass it on to him. As you can see from the below, Lee was very touched by your kind words about him:

> I've never had a conversation with Leland but would like the opportunity to just say "Thank You" for all he's done. The wealth in his contributions to the Tesla community is priceless and without his work I think its a similar analogy to imagining Tesla's legacy without the efforts of Thomas Commerford Martin.

Lee would like to write to you via snail mail, so can you send your mailing address? I will continue to act as the intermediary.

Besides being Lee's friend, I am an avid reader of his many papers. I have had the pleasure of being his proof reader for some of his last works. His biographical notes are the most enjoyable for me, while his technical papers are a challenge. I work with the text in one hand and a dictionary in the other.

Every year Lee has said that 'this is the final paper' he will write, and yet something new always peaks his imagination. Let us hope he never stops writing.

Steve Hinkley

Steve,

I was overwhelmed by the e-mail from Jeff Behary. Could you please send him an e-mail saying that I would very much like to write to him and ask him to send you his USPS address so that you can give it to me?

Hugs,

Lee

In the months that followed, we continued to correspond on many topics. Leland was obviously bitter with many people in the Tesla community, but I honestly understand why sharing many of the same sentiments with regard to the lack of historical accuracy or basic science and engineering logic.

This is also combined with a certain frustration considering so much effort to set the real stories straight was often ignored by authors and influencers looking for little more than their "fifteen minutes of fame", to use the phrase by Andy Warhol. For most of the last 50 years Lee's archive represents the largest collection of Tesla materials outside of the Nikola Tesla Museum in Belgrade, Serbia. My collection now surpasses Leland's in size but as both collections contain unique materials not found elsewhere one can hardly compare the significance of one versus another. The materials are all historically priceless and go hand-in-hand in the quest for knowledge about Nikola Tesla.

Leland asked me if I would be willing to donate functioning Tesla Coils to accompany his collection. I have reached out twice to Heinz during two separate visits and hope to make this possible, even though sadly Lee passed away in 2021.

The subject of the letters transcribed in this book are between Nikola Tesla and various people of the Westinghouse Electric Company. So much misinformation and speculation has been published about both men, their business relationship and friendship, the true significance of Tesla and his early work on polyphase motors and generators, the exploitation of Tesla's work with or without compensation, and the list goes on.

As I read through these letters, many of which were nearly illegible or difficult to read at best – it was like peering through a small window of time between two great men, geniuses of their time. I don't wish to comment or pass judgement on any of them as the window of time and scope of the letters is almost insignificant knowing the vast amount of work both individuals were doing at the time. They represent small windows of time in a vast realm of the true unknown. It is only with more historical documents and evidence that genuine and historically accurate conclusions can be made:

This is Nikola Tesla and George Westinghouse as seen by a fly on the wall.

(In Leland I. Anderson's handwriting: Paper delivered at IEEE, Southeastern Con '83, April 10-14, 1983)

WESTINGHOUSE – A CENTENNIAL: 1886-1986

CHARLES A. RUCH, CONSULTANT/HISTORIAN

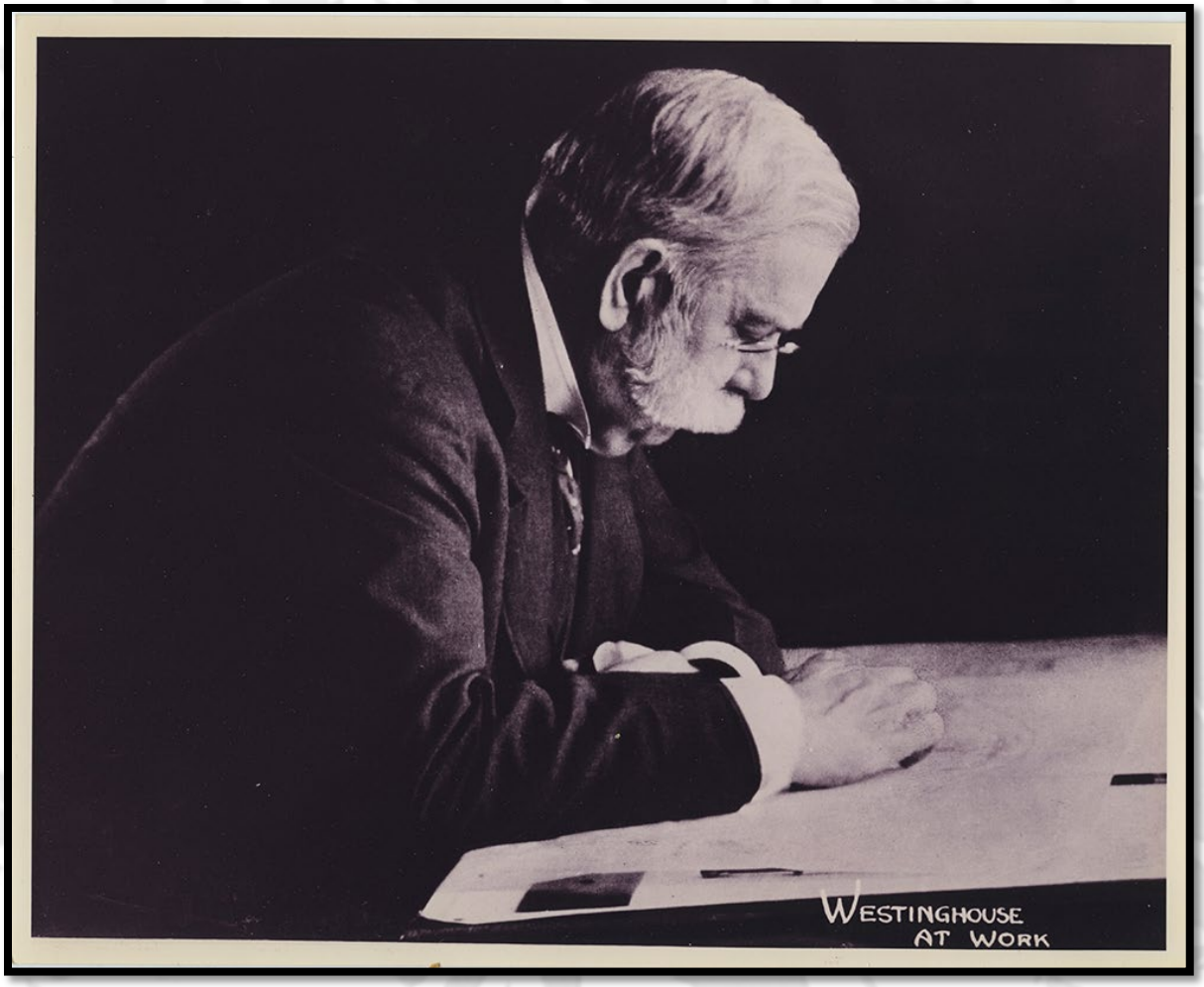
As we look forward to the centennial of the Westinghouse Electric Corporation, we come face to face with some clear realities.

For openers, we doubt if the average person cares very much whether we are 100 years old or not. We hope, of course, that those close to the Company – our employees and stockholders, and possibly some customers – will feel a measure of pride that we have reached the century mark.

True, there aren't many companies that have made it this far, and fewer still have the same name as when they began. As the same time, we are realistic enough to suspect that relatively few of our employees or stockholders or customers are aware that our centennial is just over the horizon, in 1986.

A plausible reason for this is the fact that over the years Westinghouse has been rather reticent about its history. George Westinghouse himself was of that persuasion. He prided himself on keeping no personal records. Original letters signed by Westinghouse are more scarce than those signed by George Washington.

George Westinghouse hated his picture taken. His most notable portrait was a time exposure taken secretly through the door of a nearby washroom as he sat looking over some drawings at his favorite desk in the drafting room. Fortunately this scheme – planned days in advance – worked to perfection. If you saw the original negative, there would be a man at the side of the desk, off to the right, and some files in the background. A skillful retoucher made them disappear, like a David Copperfield illusion.



"Westinghouse At Work", George Westinghouse Museum Collection, c.1864-2007, MSS 920
Detre Library and Archives, Senator John Heinz History Center

T H I S A G R E E M E N T made this fifth day

of April, 1887, between NIKOLA TESLA

and CHARLES F. PECK

WITNESSETH:

W H E R E A S the said TESLA claims to have invented certain improvements in dynamo electric machines by which the economy and efficiency of such machines can be greatly increased. And also to have invented a means or process with appropriate apparatus for obtaining the energy of electric currents from heat and also certain other electrical inventions.

Now for the purpose of developing and perfecting such inventions and taking our patents therefor and introducing such inventions and patents and realizing the commercial value thereof, it is agreed between said parties as follows:

The said TESLA shall give his time and best efforts to completing and perfecting the said invention and as fast as the same shall be in a condition to be patented patents for the same shall be taken out in the names of the said TESLA and PECK as assignee of TESLA.

(2). Said PECK shall advance the money required for taking out the patents

(3). Said PECK shall advance the money necessary to complete the said inventions and to construct the necessary apparatus to test the same inventions and patents the moneys advanced by the said PECK shall be returned to him before any profits shall be divided.

Charles F. Peck

Nikola Tesla

H. R. GARDEN,
COUNSELLOR AT LAW,
ROOM 506,
MUTUAL LIFE BUILDING,
NASSAU, CEDAR & LIBERTY STS.

New York, May 21st, 1888.

George Westinghouse, Jr., Esq.

Pittsburg, Pa.

My dear Mr Westinghouse:

As per appointment, I called upon Mr Brown this morning, and found that he, and a party by the name of Peck (whom I imagine to be a lawyer) are the owners of the Tesla patents pertaining to motors. Under a separate cover and by special delivery stamp, I send you copies of these seven patents, together with a copy of the report by Prof. Anthony on the apparatus, which, it is claimed, is covered by the patents in question.

Being in a great hurry, I am dictating this letter to you through Capt. Garden's stenographer, as I have not time to write it myself, legibly.

Brown and Peck took me to a place on Liberty street, where I was introduced to Mr Tesla, Mr Humbard being in Company with ~~him~~ the, and I was shown a great mass of apparatus, ~~consisting~~ among which were ~~of~~ five or six motors. Mr Tesla struck me as being a straightforward, enthusiastic, sort of a party; ~~and~~ but his description was not of a nature which I was enabled, entirely, to comprehend. However, I saw several points which I think are of interest. In

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the first place, as near as I can get at it, the underlying principle of this motor is the principle which Mr Shøllenberger is at work on at the present moment. The motors, as far as I could judge from the examination which I was enabled to make, are a success. They start from rest and the reversion of the direction of rotation ~~is~~ can be suddenly accomplished without any short-circuiting. They were small affairs, and were claimed to develop in the neighborhood of a half a horse power. They were very neat in workmanship and in appearance. Among the other matters which Mr Tesla showed me, was a little disc, mounted almost identically as Mr Shøllenberger's first experimental disc was mounted, ~~in~~ which Tesla showed would commence rotating so soon as it was brought in the neighborhood of a circuit through which an alternating current was flowing, and also that its direction of rotation would reverse according as its position with relation to the wire through which the current was flowing was changed. Another device which he had in operation in order to show the principle of his motor, consisted of a disc of sheet iron mounted on a shaft, which shaft ran in journals and around the outer edge of the disc was a stationary annular ring of laminated iron wound with wire similarly to the armature of a Gramme machine. When a current was sent

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through the wire the sheet iron disc would start rotating and soon attain a prodigious speed. Mr Tesla explained that in the practical operation of his motors, he preferred to use three wires all carrying alternating currents, two of the wires being connections from the wires, either primary or secondary, of an ordinary alternating circuit, while the third would be a wire carried directly from a sort of secondary winding applied to the armature of the machine. In order to avoid giving the impression that the matter was one which excited my curiosity, I made my visit short and after leaving the room in which the apparatus was working, took Brown and Peck to 17 Cortlandt street, where they stated that after having heard nothing from us for some three weeks after first communicating with Duncan, whom they supposed was our representative, they had carried on negotiations with certain strong capitalists represented by Mr Butterworth, of San Francisco, and whom I ascertained was the same party who last spring negotiated with us for use of our system and the fuel gas in San Francisco. Brown and Peck expressed a desire to deal with us, if possible, but say that unless we can let them know by ten o'clock, Friday of this week, whether or not we propose, seriously,

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looking into the matter, they will accept Butterworth's proposition, which they told me was a payment in short-term notes of about Two Hundred Thousand Dollars, and a royalty of $2.50 per H. P. The terms, of course, are monstrous; and I so told them; and they replied that they could not possibly hold the matter over longer than the date mentioned. I told them I thought there was no possibility of our considering the matter seriously, but that I would let them know before Friday. I would suggest that if you are unable to come here yourself, that Mr Kerr and Mr Schellenberger come on Tuesday night. Please advise me by telegraph onreceipt of this. They allege that Prof. Anthony has now joined the syndicate represented by Butterworth, and who proposed paying the enormous figure mentioned for the patent.

I have important matters to look after to-morrow, or otherwise would have come home to-night.

Very respectfully yours,

H R Gardener

Westinghouse
Electric Corporation

Westinghouse Building
Gateway Center
Pittsburgh Pennsylvania 15222

April 8, 1983

Dear Leland:

It was good to hear from you and have your reminder that I had neglected to send you the Byllesby letter. On resurrecting it, I find I misled you as to the word "preposterous." As you will note, the word was "monstrous." The underscoring, by the way, is not mine.

Looking at the letter now, I feel certain that if I were to ask anyone in our management hierarchy if it is all right to send you a copy of the letter, I'm sure the answer would be "no," particularly if a lawyer were involved. But I'm taking the chance on sending this to you for framing (a fairly big frame), with the understanding that it is not for publication. Should anyone visiting your study start making notes from the letter, you had better have them get in touch with me before thinking of publication.

The thing we have to remember is that the $2.50 figure is only in a memorandum of agreement; the only signed agreement makes no reference to the royalty. So much for that.

It's interesting that you mention IEEE's 100th. As a matter of fact, I will be in Orlando Monday (April 11) speaking to the Southeastcon '83, on the subject of the Westinghouse Centennial. As part of the conference they are having a session on Electrical Engineering History.

All the best!

Charlie Rush

P.S. Thanks for the congratulations on my 45th anniversary. As it happens, I will be in Orlando on the day I began, 45 years ago.

Notebook # 28

capital, for all the Baar would be a dividend & leave them still in debt to me 60 or 70,000.

#

2. Reserve Sheri but sell evrything else to them for 6% on capital & a share of possible profit. They assuming my responsibilities & my slavery to a lunatic.

#

3. Wait until this other matter determines itself successfully; then collect what comes in from Sher, make my capital intact, let the old regime return Apl. 1 & go unassisted to destruction.

#

I prefer No. 3.

#

1. If by Dec. 31 Sher proves to be unprofitable, demand a re-construction of contract placing power in my hands where it belongs. Refusal? Go into court.

2. Demand dissolution. Go into Court.

#

Can I be held for debts made beyond the capital?

#

I will buy out or sell out.

#

Since the spring of '86, the thing has gone straight down hill toward sure destruction. It must be brought to an end Feb. 1 at all hazards. This is final.

#

Nov. 1, 1888. I have just seen the drawings & description of an electrical machine lately patented by a Mr. # <Teska> Tesla, & sold to the Westinghouse Company, which will revolutionize the whole electric business of the world. It is the ~~first~~ most valuable patent since the telephone. The drawings & description show that this is the very machine, in every detail which Paige invented nearly 4 years ago. I

To appear in volume III of Mark Twain's Notebooks & Journals

furnished $1,000 for the experiments, & was to have half of the invention. We tried a direct current--& failed. We wanted to try an alternating current, but we lacked the apparatus. The $1000 was exhausted, & I would furnish nothing more because I was burdened in the 3 succeeding years with vast expenses on the Paige type-setting machine. <Teska> Tesla (& Thompson?) tried everything that we tried, as the drawings & descriptions prove; & he tried one thing more--a thing which we had canvassed--the alternating current. That solved the difficulty & achieved success.

Clarence must give market report--American heiressess buying up rotten dukes. Character as well as title considered in the market, & discounted accordingly.

Who the duke married first--next--& so on--causes of divorce. Disease--but can't name it.

<Buy hearts counters>

(Jerusalem) "Well, the Savior's been here once!")

<To start with, 5 m.--no orders. 1 m sh at 5 each 5000,000. Each 1000th is worth $5. After 500 orders, $10--aftr 1000 15 after,

<10,000 500 1,000,000> Ich werde Ihnen <ein> ~~1/500~~ 1/500 von dem Ganzen um $10,000 verkaufen (bases, $5,000,000.

Nach <1000> <orders> 500 Bestellen, um ~~<$20>~~ <$20,000> $15,000. (Ground, 10,000,000.

Nach 1000, um $20,000. (Gr. 15,000,000)
" 1500 " 25,000 (" 20,000,000
" 2000 " 30,000 (" 25,000,000) OVER

<at bottom of p. but single entry on verso is enveloped

† figures continue on next (right hand) page>

<Written at right-angles over preceding paragraph.>

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22 September 1975

Dear Mr. Anderson:

It was indeed kind of you to write about the Clemens letters to Tesla--as it happens we had already photographed these, but we might well have missed them so I am grateful for the information you sent. I have checked our files to see if we had any letters from Tesla to Mark Twain, but I can find no record that there are any. If I can be of any assistance to you in any work that you are doing on Tesla, I hope you will let me know. We do have a very few references to Tesla in Mark Twain's notebooks (and perhaps in other places), but the only one that I can find at the moment is 1 November 1888. I am sending you a copy of the typescript copy of the note in the context of other entries of the period. This notebook will appear in volume III of Mark Twain's Notebooks & Journals which we are now editing for publication by the University of California Press.

Sincerely yours,

F.A. Anderson

Frederick Anderson
Editor - Mark Twain Papers

The Mather Electric Co.,
Manchester, Conn.

March, 31st, 1888

N. Tesler, Esq.,

Metropolitan Hotel, New York, N.Y.

Dear Sir: --

I have constructed a little motor with eight poles to try the experiment of reducing its speed to one-half. With 16,000 alternations per minute it runs at about 4,000 revolutions, as I expected. Also, the alternating current generator, which we were fitting up here for the purpose of trying some experiments with your motors and which you remember came to grief by the armature striking the poles, I tried the other day as a motor, taking the currents from the same little dynamo which furnished the currents in experiments with your motors, and it ran nicely at one-third the speed of the generator. For the armature of the little motor, I made a cylinder of iron discs and placed upon it eight closed coils of wire. That is, it would be a four poled armature, and would, I am sure, although I have not tried the experiment, run at half the rate of the two poled armature in a four pole field. It seems to me that in the adaptation of your system to the general purposes of illumination and running motors and at any rate if you wanted to use converters on the system for any purpose, it would be important in order to reach a high efficiency in the converters to obtain very rapid alternations, as much as 15,000 or more per minute, and in that case this arrangement of the motor be run at a slower speed would be important.

It seems to me that the form of motor that you call the synchronous motor would be best for all the general purposes of distribution, since it comes more nearly to what are called self-regulating motors of the continuous current type. The other motor for great rotary effort, etc. gives its great effect when running at a speed considerably below that of the generator, and, of course, its speed would vary greatly under different loads; while it is just the thing that is wanted for railroad work, the other of course, if far better for all cases where steady speed is wanted.

Yours very truly,

The Mather Electric Co.

Wm. A. Anthony

WM. A. ANTHONY,
Electrician to
The Mather Electric Co.,
Manchester, Ct.

21/IV 88

N. Tesla.

My Dear Sir,

Can you not prepare a paper on your motors for the Am. Institute of Elec. Engineers sometime about the middle of May? It would be the most interesting paper that has been presented for a long time. I shall try to be there and will take part in the discussions.

Another matter. Several months ago I arranged to give a lecture before the Society of Arts in Boston on May 10th. I wrote Mr. Peck a few days ago to ask if I might describe briefly your system. The lecture is to be upon Alternating current transmission and deals with the theory of transformers and motors. Mr. Peck writes that after May 1st there will be no objections in a public lecture and I now want to ask another favor and that is the loan of one of your motors, the small size with the two armatures, one for synchronous rotation and one for rotary effort, and the fan you had fitted to them. Could you let me have these to exhibit in Boston May 10th.

Yours,

W A Anthony

The Western Union Telegraph Company

Received at the WESTERN UNION BUILDING, 196 Broadway, N. Y. May 5th, 1888

Dated: Manchester Connt.
To: Mr. Tesla
89 Liberty St.
NY

It will be in time to send the motor Monday

W. A. Anthony

AFTERNOON SESSION, MAY 16th, 1888.

THE CHAIRMAN:—At the opening of our morning session, I had to announce that through serious sickness, our President, Mr. Edward Weston, who was unanimously elected last night was unable to be present. Mr. Weston has, however, made considerable effort to be with us to-day and he comes here from a sick bed. I think in securing the services of Mr. Weston in the presidency the Institute has secured one whose international reputation will be of benefit to it through the coming year. The Institute, as you are well aware, is a society whose membership is not merely confined to New York, but extends throughout every state and territory of the union, and includes to-day almost ever country on the civilized globe. Mr. Weston's reputation as an electrical engineer is co-extensive with the membership of the Institute, and I am therefore very glad to salute him as my successor, and now to introduce him to you.

Mr. Weston took the chair, and addressed the meeting as follows:

Gentlemen and Members of the Institute: I am not quite so sick as our former president, Mr. Martin, would lead you to believe; but since yesterday I have made a few trips between the equator and the north pole. I have been jumping as you will see between pretty wide extremes. To stop the too rapid motion I have taken considerable quinine and it leaves me in a somewhat befogged condition of mind. I am therefore not feeling well enough to address the Institute in the way that I should do in accepting the presidency. I feel extremely honored by the kindness of your selection. I accept the office with grave doubts, because I fear I cannot give as much time to it as our past worthy president has done, and show in the same time such remarkable growth of the Institute. I am informed that in the year of his presidency the actual membership of the Institute has about doubled itself, an indication of excellent work. The papers that I have read, from what I have seen of the proceedings, have been worthy of the society. The character of the papers shows a con-

stant upward tendency. I hope it will continue so. We have nothing to be ashamed of in the past, and I hope we shall find nothing to be ashamed of in the future. I had intended te speak in full of the present state and future progress of electricity. I am unble to do that to-day. I really cannot stand it. Therefore I beg to apologize for disappointing you. I am not in fit condition even to occupy the President's chair, and as Mr. Martin has suggested that he would rather withdraw to-day, I would like Mr. Upton, if he would kindly do so, to accept the position this afternoon. (Applause.)

Mr. Francis R. Upton took the chair.

THE CHAIRMAN:—The first paper this afternoon is on "A New System of Alternate Current Motors and Transformers" by Mr. Tesla.

MR. GEO. M. PHELPS, JR.:—I would like about two minutes before the paper is read. I do not rise to propose a vote of thanks to our retiring President, because I think votes of thanks, like the resolutions in political conventions, "pointing with pride, &c.," have become a custom more honored in the breach than in the observance. But I do feel that a word ought to be said, and I do feel very confident that I express the general opinion in saying a word recognizing the zeal, the activity and the intelligence which has charactarized the administration of the office of President during the past year. The growth in membership, the character of the work accomplished, and, in general, all the activity of the Institute during the past year constitute a record to which I think we shall always look back with satisfaction, and with reasonable and just pride. It has been a matter of astonishment to me to observe the amount of time and the intelligent effort which so busy a man as our ex-President has found it possible to give to the interests of this Institute. He has not spared himself in any particular; there is no work that he could do that has been left undone, and our condition at the present time is a sufficient evidence of the truth of what I say, and I have not the slightest doubt that all here present join in what I say, and feel that it is no more than a meagre statement of the facts. (Applause.)

THE CHAIRMAN:—Is any formal motion to be made and entered in the minutes?

MR. PHELPS:— I think not, sir. As I expressly stated, I would prefer, as far as I am concerned, to avoid a formal motion. But

the way in which those remarks were received sufficiently justified what I said that they expressed the general opinion of the members present.

MR. MAILLOUX:—I would move that the remarks made by Mr. Phelps be heartily accepted and approved and endorsed by the society. The motion was seconded by Mr. Wheeler.

CAPT. O. E. MICHAELIS:—I would merely like to add one word to the enconium pronounced on Mr. Phelps. I have been fortunate enough to be associated with our past President in the Council during the past year and I can heartily endorse everything Mr. Phelps said; I would like, however to call the attention of the Institute to one fact to which they are indebted to our past President alone, and that is the valuable addition to our transactions in the shape of the bibliography that now appears with them regularly. That was Mr. Martin's idea, and it has been carried out by him. You all must know how much time such a thing has taken, and he has done that entirely of his own motion and for the good of the Institute. (Applause.)

THE CHAIRMAN:—I understand the motion to be that the remarks of Mr. Phelps be added in full in our minutes and with the cordial approval of the members. All those approving will signify by rising. The resolution was unanimously carried.

MR. NIKOLA TESLA:—I desire to express my thanks to Prof. Anthony for the help he has given me in this matter. I would also like to express my thanks to Mr. Pope and Mr. Martin for their aid. The notice was rather short, and I have not been able to treat the subject as extensively as I could have desired, my health not being in the best condition at present. I ask your kind indulgence, and I shall be very much gratified if the little I have done meets your approval.

Mr. Tesla read the following paper.

A NEW SYSTEM OF ALTERNATE CURRENT MOTORS AND TRANSFORMERS.

BY NIKOLA TESLA.

In the presence of the existing diversity of opinion regarding the relative merits of the alternate and continuous current systems great importance is attached to the question whether alternate currents can be successfully utilized in the operation of motors. The transformers with their numerous advantages, have afforded us a relatively perfect system of distribution; and although, as in all branches of the art, many improvements are desirable, comparatively little remains to be done in this direction. The transmission of power on the contrary, has been almost entirely confined to the use of continuous currents, and notwithstanding that many efforts have been made to utilize alternate currents for this purpose, they have, up to the present, at least as far as known, failed to give the result desired. Of the various motors adapted to be used on alternate current circuits the following have been mentioned: 1. A series motor with subdivided field. 2. An alternate current generator having its field excited by continuous currents. 3. Elihu Thomson's motor. 4. A combined alternate and continuous current motor. Two more motors of this kind have suggested themselves to me. 1. A motor with one of its circuits in series with a transformer and the other in the secondary of the transformer. 2. A motor having its armature circuit connected to the generator and the field coils closed upon themselves. These, however, I mention only incidentally.

The subject which I now have the pleasure of bringing to your notice is a novel system of electric distribution, and transmission of power by means of alternate currents, affording peculiar advantages, particularly in the way of motors, which I am confident will at once establish the superior adaptability of these currents to the transmission of power and will show that many results heretofore unattainable can be reached by their use;

results which are very much desired in the practical operation of such systems and which cannot be accomplished by means of continuous currents.

Before going into a detailed description of this system, I think it necessary to make a few remarks with reference to certain conditions existing in continuous current generators and motors, which, although generally known, are frequently disregarded.

In our dynamo machines, it is well known, we generate alternate currents which we direct by means of a commutator, a complicated device and, it may be justly said, the source of most of the troubles experienced in the operation of the machines. Now, the currents so directed cannot be utilized in the motor, but they must—again by means of a similar unreliable device—be reconverted into their original state of alternate currents. The function of the commutator is entirely external, and in no way does it affect the internal working of the machines. In reality, therefore, all machines are alternate current machines, the currents appearing as continuous only in the external circuit during their transit from generator to motor. In view simply of this fact, alternate currents would commend themselves as a more direct application of electrical energy, and the employment of continuous currents would only be justified if we had dynamos which would primarily generate, and motors which would be directly actuated by such currents.

But the operation of the commutator on a motor is two-fold; firstly, it reverses the currents through the motor, and secondly, it effects automatically, a progressive shifting of the poles of one of its magnetic constituents. Assuming, therefore, that both of the useless operations in the system, that is to say, the directing of the alternate currents on the generator and reversing the direct currents on the motor, be eliminated, it would still be necessary in order to cause a rotation of the motor, to produce a progressive shifting of the poles of one of its elements, and the question presented itself.—How to perform this operation by the direct action of alternate currents? I will now proceed to show how this result was accomplished.

In the first experiment a drum-armature was provided with two coils at right angles to each other, and the ends of these coils were connected to two pairs of insulated contact-rings as usual. A ring was then made of thin insulated plates of sheet-iron and wound with four coils, each two opposite coils being connected

together so as to produce free poles on diametrically opposite sides of the ring. The remaining free ends of the coils were then connected to the contact-rings of the generator armature so as to form two independent circuits, as indicated in figure 9. It

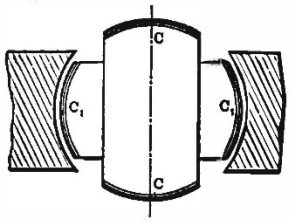


Fig. 1.

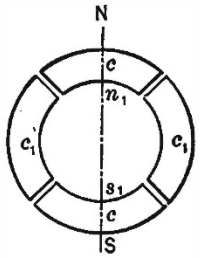


Fig. 1a.

may now be seen what results were secured in this combination, and with this view I would refer to the diagrams, figures 1 to 8*a*. The field of the generator being independently excited, the rotation of the armature sets up currents in the coils c c, varying in strength and direction in the well-known manner. In the position shown in figure 1, the current in coil c is nil while coil c_1 is traversed by its maximum current, and the connections may be such that the ring is magnetized by the coils c_1 c_1 as indicated by the letters N S in figure 1*a*, the magnetizing effect of the coils *c c* being nil, since these coils are included in the circuit of coil c.

In figure 2, the armature coils are shown in a more advanced position, one-eighth of one revolution being completed. Figure

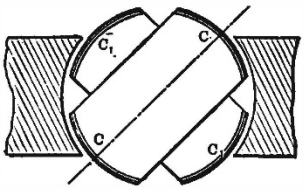


Fig. 2.

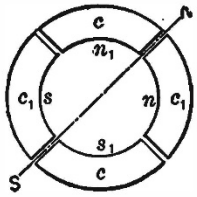


Fig. 2 a.

2*a* illustrates the corresponding magnetic condition of the ring. At this moment the coil c_1 generates a current of the same direction as previously, but weaker, producing the poles n_1 s_1 upon the ring; the coil c also generates a current of the same direction, and the connections may be such that the coils *c c* produce

the poles *n s*, as shown in figure 2*a*. The resulting polarity is indicated by the letters N S, and it will be observed that the poles of the ring have been shifted one-eighth of the periphery of the same.

In figure 3 the armature has completed one-quarter of one rev-

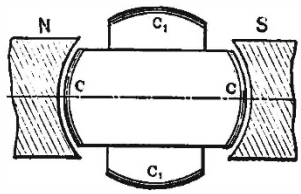


Fig. 3.

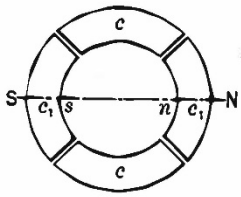


Fig. 3 a.

olution. In this phase the current in coil c is maximum, and of such direction as to produce the poles N S in figure 3*a*, whereas the current in coil c_1 is nil, this coil being at its neutral position. The poles N S in figure 3*a* are thus shifted one quarter of the circumference of the ring.

Figure 4 shows the coils c c in a still more advanced position, the armature having completed three-eighths of one revolution. At that moment the coil c still generates a current of the same direction as before, but of less strength, producing the comparatively weaker poles *n s* in figure 4*a*. The current in the coil c_1 is of the same strength, but opposite direction. Its effect is therefore, to produce upon the ring the poles n_1 s_1 as indicated

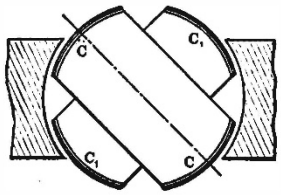


Fig. 4.

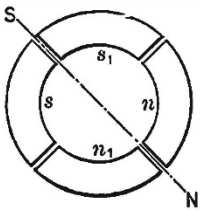


Fig. 4 a.

and a polarity, N S, results, the poles now being shifted three-eighths of the periphery of the ring.

In figure 5 one-half of one revolution of the armature is completed, and the resulting magnetic condition of the ring is indicated in figure 5*a*. Now the current in coil c is nil, while the coil c_1 yields its maximum current, which is of the same direction as previously; the magnetizing effect is, therefore, due to the coils,

c_1 c_1 alone, and, referring to figure 5*a*, it will be observed that the poles N S are shifted one half of the circumference of the ring. During the next half revolution the operations are repeated, as represented in the figures 6 to 8*a*.

A reference to the diagrams will make it clear that during one revolution of the armature the poles of the ring are shifted once around its periphery, and each revolution producing like effects, a rapid whirling of the poles in harmony with the rotation of the armature is the result. If the connections of either one of the circuits in the ring are reversed, the shifting of the poles is made to progress in the opposite direction, but the operation is identi-

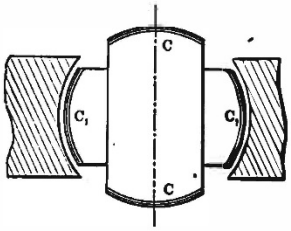


Fig. 5.

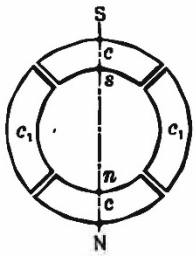


Fig. 5 a.

cally the same. Instead of using four wires, with like result, three wires may be used, one forming a common return for both circuits.

This rotation or whirling of the poles manifests itself in a series of curious phenomena. If a delicately pivoted disc of steel or other magnetic metal is approached to the ring it is set in rapid rotation, the direction of rotation varying with the position of the disc. For instance, noting the direction outside of the ring it will be found that inside the ring it turns in an opposite direction, while it is unaffected if placed in a position symmetrical to the ring. This is easily explained. Each time that a pole approaches, it induces an opposite pole in the nearest point on the disc, and an attraction is produced upon that point; owing to this, as the pole is shifted further away from the disc a tangential pull is exerted upon the same, and the action being constantly repeated, a more or less rapid rotation of the disc is the result. As the pull is exerted mainly upon that part which is nearest to the ring, the rotation outside and inside, or right and left, respectively, is in opposite directions, figure 9. When placed symmetrically to the ring, the pull on the opposite sides of the disc being equal

no rotation results. The action is based on the magnetic inertia of the iron ; for this reason a disc of hard steel is much more affected than a disc of soft iron, the latter being capable of very rapid variations of magnetism. Such a disc has proved to be a

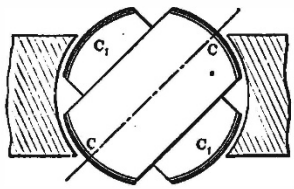


Fig. 6.

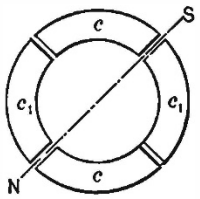


Fig. 6 a.

very useful instrument in all these investigations, as it has enabled me to detect any irregularity in the action. A curious effect is also produced upon iron filings. By placing some upon a paper and holding them externally quite closeto the ring they are set in a vibrating motion, remaining in the same place, although the paper may be moved back and forth ; but in lifting the paper to a certain height which seems to be dependent on the intensity of the poles and the speed of rotation, they are thrown away in a direction always opposite to the supposed movement of the poles. If a paper with filings is put flat upon the ring and the current turned on suddenly, the existence of a magnetic whirl may easily be observed.

To demonstrate the complete analogy between the ring and a revolving magnet, a strongly energized electro-magnet was rotated by mechanical power, and phenomena identical in every particular to these mentioned above were observed.

Obviously, the rotation of the poles produces corresponding inductive effects and may be utilized to generate currents in a

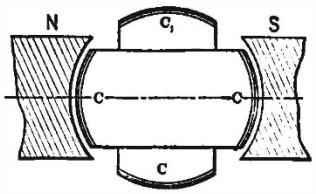


Fig. 7.

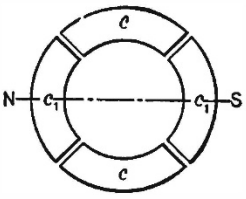


Fig. 7 a.

closed conductor placed within the influence of the poles. For this purpose it is convenient to wind a ring with two sets of

superimposed coils forming respectively the primary and secondary circuits, as shown in figure 10. In order to secure the most economical results the magnetic circuit should be completely closed, and with this object in view the construction may be modified at will

The inductive effect exerted upon the secondary coils will be

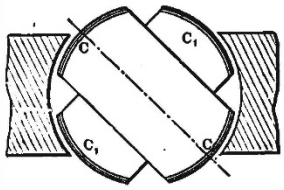


Fig. 8.

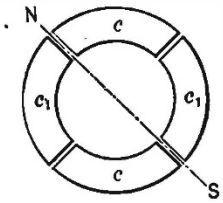


Fig. 8 a.

mainly due to the shifting or movement of the magnetic action; but there may also be currents set up in the circuits in consequence of the variations in the intensity of the poles. However, by properly designing the generator and determining the magnetizing effect of the primary coils, the latter element may be made to disappear. The intensity of the poles being maintained constant, the action of the apparatus will be perfect, and the same result will be secured as though the shifting were effected by means of a commutator with an infinite number of bars. In such case the theoretical relation between the energizing effect of each set of primary coils and their resultant magnetizing effect may be expressed by the equation of a circle having its centre coinciding with that of an orthogonal system of axes, and in which the radius represents the resultant and the co-ordinates both of its components. These are then respectively the sine and cosine of the angle a between the radius and one of the axes ($O\ X$). Referring to figure 11, we have $r = x_2 + y_2$; where $x = r \cos a$. and $y = r \sin a$.

Assuming the magnetizing effect of each set of coils in the transformer to be proportional to the current—which may be admitted for weak degrees of magnetization—then $x = Kc$ and $y = Kc^1$, where K is a constant and c and c^1 the current in both sets of coils respectively. Supposing, further, the field of the generator to be uniform, we have for constant speed $c^1 = K^1 \sin a$ and $c = K^1 \sin\ (90° + a) = K^1 \cos a$, where K^1 is a constant. See figure 12.

Therefore, $x = Kc = KK^1 \cos a$;
$y = Kc^1 = KK^1 \sin a$, and
$KK^1 = r$.

That is, for a uniform field the disposition of the two coils at right angles will secure the theoretical result, and the intensity of the shifting poles will be constant. But from $r^2 = x^2 + y^2$ it follows that for $y = 0$, $r = x$; it follows that the joint magnetizing effect of both sets of coils should be equal to the effect of one set when at its maximum action. In transformers and in a certain class of motors the fluctuation of the poles is not of great importance, but in another class of these motors it is desirable to obtain the theoretical result.

In applying this principle to the construction of motors, two typical forms of motor have been developed. First, a form having a comparatively small rotary effort at the start but maintaining a perfectly uniform speed at all loads, which motor has been termed synchronous. Second, a form possessing a great rotary effort at the start, the speed being dependent on the load.

These motors may be operated in three different ways: 1. By the alternate currents of the source only. 2. By a combined action of these and of induced currents. 3. By the joint action of alternate and continuous currents.

The simplest form of a synchronous motor is obtained by winding a laminated ring provided with pole projections with four

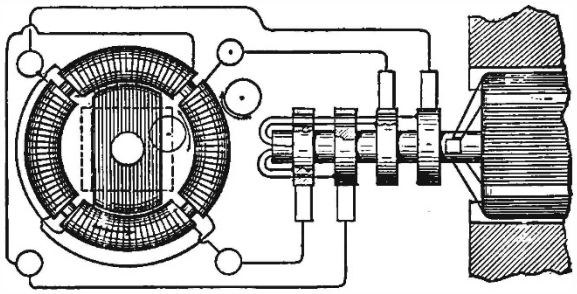


Fig. 9.

coils, and connecting the same in the manner before indicated. An iron disc having a segment cut away on each side may be used as an armature. Such a motor is shown in figure 9. The disc being arranged to rotate freely within the ring in close proximity to the projections, it is evident that as the poles are shifted it will, owing to its tendency to place itself in such a position as to

embrace the greatest number of the lines of force, closely follow the movement of the poles, and its motion will be synchronous with that of the armature of the generator; that is, in the peculiar disposition shown in figure 9, in which the armature produces by one revolution two current repulses in each of the circuits. It is evident that if, by one revolution of the armature, a greater

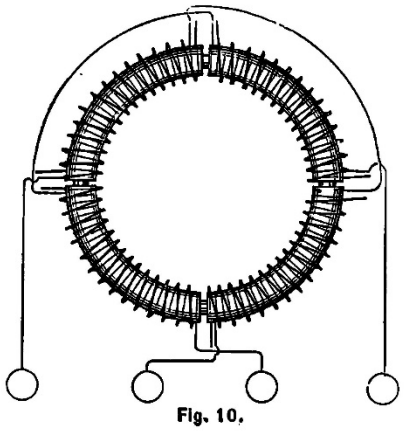


Fig. 10.

number of impulses is produced, the speed of the motor will be correspondingly increased. Considering that the attraction exerted upon the disc is greatest when the same is in close proximity to the poles, it follows that such a motor will maintain exactly the same speed at all loads within the limits of its capacity.

To facilitate the starting, the disc may be provided with a coil closed upon itself. The advantage secured by such a coil is evident. On the start the currents set up in the coil strongly energize the disc and increase the attraction exerted upon the same by the ring, and currents being generated in the coil as long as the speed of the armature is inferior to that of the poles, considerable work may be performed by such a motor even if the speed be below normal. The intensity of the poles being constant, no currents will be generated in the coil when the motor is turning at its normal speed.

Instead of closing the coil upon itself, its ends may be connected to two insulated sliding rings, and a continuous current supplied to these from a suitable generator. The proper way to start such a motor is to close the coil upon itself until the normal speed is reached, or nearly so, and then turn on the continuous current. If the disc be very strongly energized by a continuous

current the motor may not be able to start, but if it be weakly energized, or generally so that the magnetizing effect of the ring is preponderating it will start and reach the normal speed. Such a motor will maintain absolutely the same speed at all loads. It has also been found that if the motive power of the generator is not excessive, by checking the motor the speed of the generator is diminished in synchronism with that of the motor. It is characteristic of this form of motor that it cannot be reversed by reversing the continuous current through the coil.

The synchronism of these motors may be demonstrated experimentally in a variety of ways. For this purpose it is best to employ a motor consisting of a stationary field magnet and an armature arranged to rotate within the same, as indicated in figure 13. In this case the shifting of the poles of the armature produces a rotation of the latter in the opposite direction. It results therefrom that when the normal speed is reached, the poles of the armature assume fixed positions relatively to the field magnet and the same is magnetized by induction, exhibiting a distinct pole on each of the pole-pieces. If a piece of soft iron is approached to the field magnet it will at the start be attracted with a rapid vibrating motion produced by the reversals of polarity of the magnet, but as the speed of the armature increases the vibrations become less and less frequent and finally entirely cease. Then the iron is weakly but permanently attracted, showing that

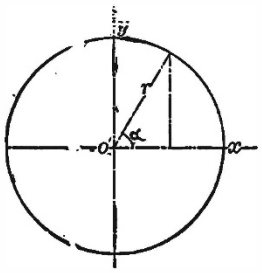


Fig. 11.

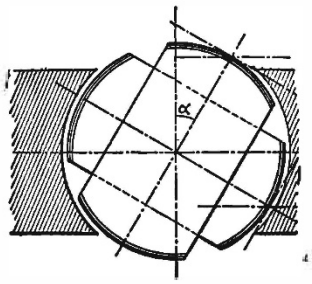


Fig. 12.

the synchronism is reached and the field magnet energized by induction.

The disc may also be used for the experiment. If held quite close to the armature it will turn as long as the speed of rotation of the poles exceeds that of the armature; but when the normal speed is reached or very nearly so, it ceases to rotate and is permanently attracted.

A crude but illustrative experiment is made with an incandescent lamp. Placing the lamp in circuit with the continuous current generator and in series with the magnet coil, rapid fluctuations are observed in the light in consequence of the induced currents set up in the coilat the start; the speed increasing, the fluctuations occur at longer intervals, until they entirely disappear, showing

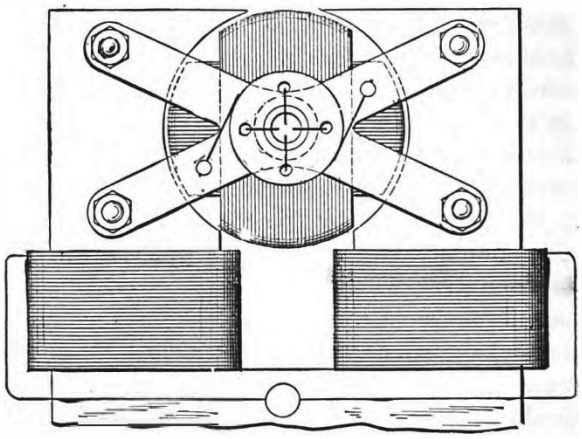


Fig. 13.

that the motor has attained its normal speed.

A telephone receiver affords a most sensitive instrument; when connected to any circuit in the motor the synchronism may be easily detected on the disappearance of the induced currents.

In motors of the synchronous type it is desirable to maintain the quantity of the shifting magnetism constant, especially if the magnets are not properly subdivided.

To obtain a rotary effort in these motors was the subject of long thought. In order to secure this result it was necessary to make such a disposition that while the poles of one element of the motor are shifted by the alternate currents of the source, the poles produced upon the other elements should always be maintained in the proper relation to the former, irrespective of the speed of the motor. Such a condition exists in a continuous current motor; but in a synchronous motor, such as described, this condition is fulfilled only when the speed is normal.

The object has been attained by placing within the ring a properly subdivided cylindrical iron core wound with several independent coils closed upon themselves. Two coils at right angles as

in figure 14, are sufficient, but a greater number may be advantageously employed. It results from this disposition that when the poles of the ring are shifted, currents are generated in the closed armature coils. These currents are the most intense at or near the points of the greatest density of the lines of force, and their effect is to produce poles upon the armature at right angles to those of the ring, at least theoretically so; and since this action is entirely independent of the speed—that is, as far as the location of the poles is concerned—a continuous pull is exerted upon the periphery of the armature. In many respects these motors are similar to the continuous current motors. If load is put on, the speed, and also the resistance of the motor, is diminished and more current is made to pass through the energizing coils, thus increasing the effort. Upon the load being taken off, the counter-electromotive force increases and less current passes through the primary or energizing coils. Without any load the speed is very nearly equal to that of the shifting poles of the field magnet.

It will be found that the rotary effort in these motors fully equals that of the continuous current motors. The effort seems to be greatest when both armature and field magnet are without any projections; but as in such dispositions the field cannot be concentrated, probably the best results will be obtained by leaving pole projections on one of the elements only. Generally, it

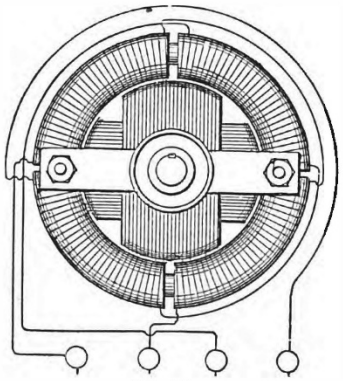


Fig. 14.

may be stated that the projections diminish the torque and produce a tendency to synchronism.

A characteristic feature of motors of this kind is their capacity of being very rapidly reversed. This follows from the peculiar

action of the motor. Suppose the armature to be rotating and the direction of rotation of the poles to be reversed. The apparatus then represents a dynamo machine, the power to drive this machine being the momentum stored up in the armature and its speed being the sum of the speeds of the armature and the poles.

If we now consider that the power to drive such a dynamo would be very nearly proportional to the third power of the speed, for that reason alone the armature should be quickly reversed. But simultaneously with the reversal another element is brought into action, namely, as the movement of the poles with respect to the armature is reversed, the motor acts like a transformer in which the resistance of the secondary circuit would be abnormally diminished by producing in this circuit an additional electro-motive force. Owing to these causes the reversal is instantaneous.

If it is desirable to secure a constant speed, and at the same time a certain effort at the start, this result may be easily attained in a variety of ways. For instance, two armatures, one for torque and the other for synchronism, may be fastened on the same shaft and any desired preponderance may be given to either one, or an armature may be wound for rotary effort, but a more or less pronounced tendency to synchronism may be given to it by properly constructing the iron core; and in many other ways.

As a means of obtaining the required phase of the currents in both the circuits, the disposition of the two coils at right angles is the simplest, securing the most uniform action; but the phase may be obtained in many other ways, varying with the machine employed. Any of the dynamos at present in use may be easily

Fig. 15.

Fig. 16.

Fig. 17.

adapted for this purpose by making connections to proper points of the generating coils. In closed circuit armatures, such as used in the continuous current systems, it is best to make four derivations from equi-distant points or bars of the commutator, and to connect the same to four insulated sliding rings on the shaft. In

this case each of the motor circuits is connected to two diametrically opposite bars of the commutator. In such a disposition the motor may also be operated at half the potential and on the three-wire plan, by connecting the motor circuits in the proper order to three of the contact rings.

In multipolar dynamo machines, such as used in the converter systems, the phase is conveniently obtained by winding upon the armature two series of coils in such a manner that while the coils of one set or series are at their maximum production of current, the coils of the other will be at their neutral position, or nearly so, whereby both sets of coils may be subjected simultaneously or successively to the inducing action of the field magnets.

Generally the circuits in the motor will be similarly disposed, and various arrangements may be made to fulfill the requirements; but the simplest and most practicable is to arrange primary circuits on stationary parts of the motor, thereby obviating, at least in certain forms, the employment of sliding contacts. In such a case the magnet coils are connected alternately in both the circuits; that is, 1, 3, 5.....in one, and 2, 4, 6.....in the other, and the coils of each set of series may be connected all in the same manner, or alternately in opposition; in the latter case a motor

Fig. 18.

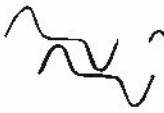


Fig. 19.

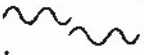


Fig. 20.

Fig. 21.

with half the number of poles will result, and its action will be correspondingly modified. The figures 15, 16, and 17, show three different phases, the magnet coils in each circuit being connected alternately in opposition. In this case there will be always four poles, as in figures 15 and 17, four pole projections will be neutral, and in figure 16 two adjacent pole projections will have the same polarity. If the coils are connected in the same manner there will be eight alternating poles, as indicated by the letters n' s' in figure 15.

The employment of multipolar motors secures in this system an advantage much desired and unattainable in the continuous current system, and that is, that a motor may be made to run exactly at a predetermined speed irrespective of imperfections in construction, of the load, and, within certain limits, of electromotive force and current strength.

In a general distribution system of this kind the following plan should be adopted. At the central station of supply a generator should be provided having a considerable number of poles. The motors operated from this generator should be of the synchronous type, but possessing sufficient rotary effort to insure their starting. With the observance of proper rules of construction it may be admitted that the speed of each motor will be in some inverse proportion to its size, and the number of poles should be chosen accordingly. Still exceptional demands may modify this rule. In view of this, it will be advantageous to provide each motor with a greater number of pole projections or coils, the number being preferably a multiple of two and three. By this means, by simply changing the connections of the coils, the motor may be adapted to any probable demands.

If the number of the poles in the motor is even, the action will be harmonious and the proper result will be obtained; if this is not the case, the best plan to be followed is to make a motor with a double number of poles and connect the same in the manner before indicated, so that half the number of poles result. Suppose, for instance, that the generator has twelve poles, and it would be desired to obtain a speed equal to $\frac{12}{7}$ of the speed of the generator. This would require a motor with seven pole projections or magnets, and such a motor could not be properly connected in the circuits unless fourteen armature coils would be provided, which would necessitate the employment of sliding contacts. To avoid this, the motor should be provided with fourteen magnets and seven connected in each circuit, the magnets in each circuit alternating among themselves. The armature should have fourteen closed coils. The action of the motor will not be quite as perfect as in the case of an even number of poles, but the drawback will not be of a serious nature.

However, the disadvantages resulting from this unsymmetrical form will be reduced in the same proportion as the number of the poles is augmented.

If the generator has, say, n, and the motor n_1 poles, the speed of the motor will be equal to that of the generator multiplied by $\frac{n}{n_1}$.

The speed of the motor will generally be dependent on the number of the poles, but there may be exceptions to this rule. The speed may be modified by the phase of the currents in the

circuits or by the character of the current impulses or by intervals between each or between groups of impulses. Some of the possible cases are indicated in the diagrams, figures 18, 19, 20 and 21, which are self-explanatory. Figure 18 represents the condition generally existing, and which secures the best result. In such a case, if the typical form of motor illustrated in figure 9 is employed, one complete wave in each circuit will produce one revolution of the motor. In figure 19 the same result will be effected by one wave in each circuit, the impulses being successive; in figure 20 by four, and in figure 21 by eight waves.

By such means any desired speed may be attained; that is, at least within the limits of practical demands. This system possesses this advantage besides others, resulting from simplicity. At full loads the motors show an efficiency fully equal to that of the continuous current motors. The transformers present an additional advantage in their capability of operating motors. They are capable of similar modifications in construction, and will facilitate the introduction of motors and their adaptation to practical demands. Their efficiency should be higher than that of the present transformers, and I base my assertion on the following:—

In a transformer as constructed at present we produce the currents in the secondary circuit by varying the strength of the primary or exciting currents. If we admit proportionality with respect to the iron core the inductive effect exerted upon the secondary coil will be proportional to the numerical sum of the variations in the strength of the exciting current per unit of time; whence it follows that for a given variation any prolongation of the primary current will result in a proportional loss. In order to obtain rapid variations in the strength of the current, essential to efficient induction, a great number of undulations are employed, from this practice various disadvantages result. These are increased cost and diminished efficiency of the generator, more waste of energy in heating the cores, and also diminished output of the transformer, since the core is not properly utilized, the reversals being too rapid. The inductive effect is also very small in certain phases, as will be apparent from a graphic representation, and there may be periods of inaction, if there are intervals between the succeeding current impulses or waves. In producing a shifting of the poles in a transformer, and thereby inducing currents, the induction is of the ideal character, being always

maintained at its maximum action. It is also reasonable to assume that by a shifting of the poles less energy will be wasted than by reversals.

DISCUSSION.

MR. T. C. MARTIN :—Prof. Anthony I believe, is here, and as he has given this subject some attention I think he might very properly supplement Mr. Tesla's paper with some remarks.

MR. TESLA :—I want to express once more my best thanks to Prof. Anthony for aiding me in many respects, and I hope he will be able to enlighten you upon many of the features in this system that I was unable to explain at present.

PROF. W. A. ANTHONY:—Mr. President and Gentlemen: I have been referred to as having had something to do with these forms of motor. I am very glad to be able to add my testimony to what Mr. Tesla has already given you in regard to their action, and I confess that on first seeing the motors the action seemed to me an exceedingly remarkable one. After my first visit to Mr. Tesla's works some of the motors, I think these very two that you see here on the table, were brought to me to make some tests of their efficiency, and probably you will be more interested in that than anything else that I might say. I am sorry to have not brought with me the exact figures we obtained, but I can give you from memory something of the result. This little motor that you see here gave us about half a horse power, and had an efficiency of something above fifty per cent., which I considered a very fair efficiency for a motor of this size, as we cannot expect with such small motors to get as high efficiency as we can with larger ones. This I believe is the armature that Mr. Tesla calls the armature for high rotary effort. This little pulley which is only about three inches in diameter gave a pull of something like fifty pounds, as I remember it, on turning on the current, so that you see the rotary effort is very considerable and that is also shown in the quickness with which the armature will reverse its motion on reversing the relation of the two currents which pass through the two opposite coils. That could be done by shifting two of the wires or simply shifting a reversing key in one of the circuits, and the armature would stop and reverse its motion so quickly that it was almost impossible to tell when the change took place. That shows, as I have said, the very considerable rotary effort that the armature presents.

This motor (referring to the second specimen) gave us, I think, about one and one-quarter horse power and showed a somewhat higher efficiency than the other, a little over sixty per cent. This would run, with the armature as here constructed, almost at the speed of the generator even under a very heavy load. When the load was brought up to the maximum load, where the efficiency began to fall off somewhat, the speed of rotation was reduced. As I remember now, it was reduced to about twenty-eight hundred, and the speed, you see, kept up very nearly to that of the generator under heavy load.

I can add very little to what Mr. Tesla has already given you in regard to these motors. I have no question but that all of you would be as much interested as I was in seeing them work. That is really the best way in which to deter mine what the motors will do. (Applause.)

Mr. Tesla :—Mr. President and Gentlemen: Prof. Anthony just made the remark that the speed of this motor fell off when the load was increased. That was due to the fact that this armature was designed to secure a considerable effort from the start. But if we make an armature which is only designed for synchronism, the speed will always be the same no matter what the load; only there is a disadvantage that at the outset the rotary effort is so small that it is apt not to start. It would generally start if put in a proper position, but if not put in a proper position it might not start. If we employ an armature consisting of a cutaway block of steel with a coil, it will maintain speed at all loads. The importance of maintaining the intensity of the pole constant is that, if this can be produced, we can utilize, instead of the subdivided armature, an ordinary steel block with the same result. It is only desired to close the magnetic field. You can readily see, if the poles are fixed, that it is not necessary to sub-divide the armature, if the intensity of the force is constantly maintained the same. But, if the intensity is not maintained the same, then it is necessary to subdivide, and generally in the results that I have obtained I have found that it is necessary to subdivide. I attribute the good results obtained by the tests of Professor Anthony to the fact that the dynamo used by him has a powerful field and a small armature, and the field is very concentrated, and for that reason, probably, the result is nearer the theoretical.

Prof. Thomson :—I have certainly been very much interested

in the description given by Mr. Tesla of his new and admirable little motor. I have, as probably you may be aware, worked in somewhat similar directions and towards the attainment of similar ends. The trials which I have made have been by the use of a single alternating current circuit, not a double alternating circuit; a single circuit supplying a motor constructed to utilize the alternation and produce rotation. I have carried on since the last annual meeting of the Institute the development and perfecting, as far as my time allowed, of a closed circuit armature, if we may so term it, related to the alternating field. That is the plan which I used and which I brought to the notice of the Institute last year; it was to make a laminated field and in that field to place an armature, also laminated, winding upon the armature a coil, which periodically is close-circuited during the revolution by a suitable commutator or circuit-closing device. I have made several such motors on different designs and they uniformly start from a state of rest and develop power, and some of them show, at speeds close to the rate of alternations of the dynamo, a tendency to synchronize. Their rotary effort in most cases is a little greater, nearer that point than at other points. I hope before a long while to bring most of these results before the notice of the Institute, and I would therefore prefer delaying further remarks on motors of this description. I certainly think there is a field for alternating motors, and there is undoubtedly an opportunity for obtaining motors which possess even some advantages over the continuous current motors. (Applause.)

Mr. Tesla:—Gentlemen, I wish to say that the testimony of such a man as Prof. Thomson, as being foremost in his profession, flatters me very much. I might say that I have worked in the same line with Prof. Thomson at a period when the invention of Prof. Thomson was not known to me. I had a motor identically the same as that of Prof. Thomson, but I was anticipated by him. I believe that although that particular form of motor has the disadvantage that a pair of brushes must be employed to short-circuit the armature coil, that such a form of motor may be made practicable, for the simple reason that a motor resembles a transformer, and such a transformer, we well know, can be brought to a very high efficiency. On the other hand, the armature may be provided with conductors that are of comparatively low resistance, and it is a mere matter of making a perfect arrangement for short circuiting. You will see the

advantage of this disposition of the closed circuit coil—that this action is maintained always at the maximum, and it is indeed more perfect than if the polarities were shifted by means of a commutator.

THE CHAIRMAN:—Unless there are some other remarks on this subject we shall have to pass to the consideration of the next paper. I think thanks are due to Mr. Tesla for his paper. The next paper in order is "Underground Electrical Systems in Europe and America," by Prof. G. W. Plympton, of the Brooklyn Subway Board.

The Gerlach

55 West Twenty seventh St.

Dec. 1/88

Dear Mr Tesla

I am much obliged for your kind letter and write more particularly to inform you of the condition of my health. As you may already know I have come into the city with all my family and we are all at the above address where we expect to remain for a few weeks.

Mr. Brown lives quite near and I see him frequently. Soon after coming to the city I took a severe cold and have not been able to leave my room since, but the Dr. assures me that I have recovered from the effects of it and that with care I will be able to be out again next week.

I hardly think that the Westinghouse people will choose their option before Jan. 5. We must be careful not to give any excuse for delay beyond that time – would it not be better to avoid introducing and new thing to their attention?

Every new device will lead to better experiment and we will soon be running into the 6th month used up in this way. Of course, they could use up six years in the same way if we would allow it.

Don't understand me to be finding any fault with you – for I am not. You have done splendidly and I fully appreciate all your zeal, industry and genius.

Your motto of "Excelsior" is a good one, but I merely suggest that just now it would be well to close up the present deal & that in order to do this must close out the present experiments and not institute any new ones.

All of the family unite with me in best wishes for your good health, prosperity & welfare.

C. F. Peck

The Westinghouse Electric Company

Pittsburgh, Pa., U.S.A.

December 13, 1888

Mr. Nicola Tesla,

Pittsburg, Pa.

Dear Sir:

In accordance with conversation, last night, this Company has decided, to accept the option to purchase your interest in the Tesla Electric Light & Manufacturing Co., and in your contracts with that Company, upon payment of $950.00, cash, today, being the balance of the first payment of $1000.00 - $50.00 having already been paid you, - and the balance, $4000.00, to be paid in cash, Feb. 1, 1889, together with two hundred shares of the capital stock of The Westinghouse Electric Company.

Yours truly,

The Westinghouse Electric Company,

H. M. Byllesby

Vice president & General Manager

WM. A. ANTHONY

ELECTRICIAN TO
THE MATHER ELECTRIC CO.,
MANCHESTER, CT.

Jan 16 '89

N. Tesla

My dear Sir

I have to thank you for your very full reply to my letter. I have taken steps to have the field reduced by increasing the number of sections to 44 in place of 40. I have also arranged to take off the boiler iron heads and fill up wth sheet iron held by heads like this.

I tried cast iron at first and found it to heat a great deal more than the boiler iron. I noted a naked core in the field and the cast iron got hot enough in an hour to char paper pasted on it more than the wrot iron even has when covered with wire and the machine delivering its 250 amps for hours. But the wrot heads do char the paper somewhat. I think enough to make it a conductor in place of an insulator and so cause a burnout of the armature. I did not try brass as a complete armature but substituted brass for one of the iron heads and an armature core that I ran in the excited field. The conductivity of brass is not much different from that of good wrot iron and so far as induction currents are concerned should be heated about the same in the same field.

It was heated nearly as much which showed to me that the heating of the iron is due mainly to induction currents and not to magnetic friction. The induction in the iron should be greater since iron of itself helps to strengthen the field. The greater heating of the cast iron was no doubt to the magnetic friction. Substituting plates of sheet iron for the two heads will get over some of the induction currents, but what troubles me is the great amount of heat in the body of the armature the whole core (naked) gets warmer than the armature should when doing its full work. My field is what the English writers call a weak field it is only about 12,000 C.G.S. units while English makers claim to have worked successfully up to 20,000 units and I have figured the strength of the field in the case of several machines from the data given and found 15,000 to 16,000, one of these had an armature 18" diameter and now I think at 800 rev. They all speak of "pure charcoal iron" as the material of the armature core. If there is any such thing as getting an iron that will not heat in a field of the strength I am using, I would like to find it.

I sent a set of washers to bolt where they have a very fine annealing furnace and had them annealed. I

don't know how long they were not particularly improved. The armature was little if any better. You differ from others in regard to the oxide. The oxide formed as you describe is mainly the magnetic oxide which is magnetized and demagnetized with difficulty, and adds, by the magnetic friction, to the heating. Most authorities say the plates should be pickled and the oxide removed. I have done all these things but still my cores heat. I have hoped the "Jaggers Tripple Annealed" would be better but it does not correct and I told there is something better still but cannot learn what it is or where to get it.

I know my field is not very strong for the characteristic scarcely goes beyond the straight line. The machine is very sensitive to change of speed or warming of the field. Two ohms resistor added to a field of 18 ohms will run the potential down from 125 to 75 volts. It is a great deal to more sensitive that I wish it was.

I wish I could get over the heating of the core for I want to keep the armature resistance down, but I don't see how to do it till I can find some better iron.

With kind regards, yours faithfully,

Wm. A. Anthony

WM. A. ANTHONY
ELECTRICIAN TO
THE MATHER ELECTRIC CO.,

MANCHESTER, CT.

N. Tesla

My dear Sir

I am in trouble and write you for help. I have designed a new machine to use a much stronger field than the old one. – I have an armature core 12” diam, 15” long, and with 40 coils one turn each get 125V at 800 rev. But the core heats excessively. The plates are #28 sheet iron from Laufman Apollo Penn. They are insulated from the shaft by thin fiber cemented on and turned true. There is tissue paper between them and every fifth plate a piece of heavy paper. A magneto will ring across the tissue never across the thick paper. The core is held together by end plates of boiler iron best flange iron screwed on the shaft. These plates finish about 7/16” thick. They heat much more than the body of the armature. On one that burned out the other day the paper in contact with that plate charred black and burned between the sheet iron for a half inch in from the end plates beyond that point it was not discolored. There are no bolts through the core. A brass plate heats nearly as much as the iron.

Can you suggest any remedy? I have ordered #30 tripple annealed Jaggers iron imported but have not received it I hear there is a better iron still can you tell me what and where to get it?

Yours in haste,

W. A. Anthony

*Author’s note: The special iron he was looking for was a the secret to Westinghouse transformer efficiency, “Bessimer steel”, which in which oxygen was used in the manufacturing process to remove impurities, specifically carbon.

Westinghouse Electric & Manufacturing Company

Pittsburgh, PA., U.S.A., June 22, 1891

Mr. Nicola Tesla.

My Dear Sir:

Enclosed I send you a clipping of the Pittsburgh Dispatch, which will undoubtably prove of interest to you. When you peruse the article you will find that I was correct, when I stated in the paper a few years ago that you were rapidly gaining a hemispherical reputation as one of the greatest electrical inventors of our age.

Yours truly,

Ernest H. Heinrichs

Westinghouse Electric & Manufacturing Company,

Pittsburg, Pa.

January 27, 1893

Mr. N. Tesla,

The Gerlach,

27th St., New York.

Dear Mr. Tesla: -

Your valuable favor of the 23rd is received. I will get a copy of the "London Electrical Review" of Jan. 13, 1893, and give the matter proper attention as you suggest.

Thanking you, I remain,

Yours truly,

Lemuel Bannister

Vice Prest. & Gen. Manager

No. _____

Pittsburgh, Pa. April 30, 1893

N. Tesla. Esq
New York

W. E. & M. Co.'s Order No._____
Purchaser's Order No._____

Bought of Westinghouse Electric & Manufacturing Company.

Terms. _____

1892					
Feb	9	1 – Tesla Motor as per specifications			
		furnished	exper.	200.00	200.00
Dec	12	1 – 24 Pole A. C. Motor Armature	exper.	25.00	25.00
Jan	5	3 – Rings of Sheet Iron	N. Tesla	5.00	5.00
Mar	3	2 – Laminated Magnets	N. T.	70.00	70.00
"	18	2 – 11 2 S I. P. Tesla Motor	75.00	150.00	
"		2 – 1 "	Tesla El. Co.	107.00	
"		1 - " 0 W. C. Exciter	Experiment	125.00	382.00
"	21	1 - E 500 Volt Motor			
		1 – Pulley			
		1 – Fuse			
		N.T. {		168.00	
			less 30%	50.40	
				117.60	
			less 10%	11.76	105.84
					784.84

W. A. ANTHONY,
MANCHESTER, CONN.

Sept. 26, '93

Mr. Nikola Tesla,

My dear Sir,

Thank you for the copy of your lecture which received yesterday. I am very glad to have it in this form for although I had read it as it appeared in the electrical journals that is not a very convenient form for reference and a lecture like yours is not one to be read and laid aside. Your illustrations of the relations between capacity and self-induction and vibration frequency are novel and very striking and bring out in a very clear manner very interesting results. I have reread the paper with great pleasure.

You know my controversial habit and my tendency to take the "other" side of a question, sometimes mere for the sake of argument, and I want to suggest a question of too as to the effect of those high frequency discharges on the human organism.

You show that the hand may approach so near as to receive the brush discharge without any suffering or inconvenience, and remark that a far less amount of energy applied to the body in the form of low frequency or continuous currents would cause death. How much energy is spent on your body when you take that brush discharge? You state that the PD of your coil is about 200,000 volts. How much current do you transfer at that pressure? 1/100 amp would mean 2000 watts or 2 2/3 HP. Does your generator when you are performing these effects deliver more than that?

If the current is not more than 1/100 amp and the resistance of the body is 2000 ohms it will require only 20 volts to maintain it and the balance of your 200,000 volts is expended in the air across which the discharge must leap to reach your hand.

But supposing the current to be 1/10 amp in which case the load of 30 HP would be thrown on your generator every time a discharge took place, there would still be expended on your body only 200,000 volts x 1/10 amp or 20 watts, the balance of the 20,000 watt being expended in the air. How does this strike you?

Faithfully yours,

W. A. Anthony

Westinghouse Electric & Manufacturing Company

Pittsburg, Pa.

Room 27, Westinghouse Bldg.,

March 13, 1895

Mr. Nikola Tesla,

Hotel Gerlach,

New York, N. Y.

My Dear Sir: --

Noticing by to-day's papers that you had a serious loss by the fire in your factory on South Fifth Avenue, I hasten to offer you my sincerest regret, and I trust you were well insured and will be able to soon find another suitable location to carry on your work.

Yours very truly,

Ernest H. Heinrich

The Gerlach

New York City, March 22nd, 1895

Mr. Albert Schmid,

Pittsburgh, Pa.

My Dear Mr. Schmid: -

You have, no doubt, learned through the papers of the unfortunate accident which has deprived me of all my apparatus, and some results of my recent work. I must now rebuild my laboratory, and, will require some machinery. I shall write a letter to the Westinghouse Company about this after consulting Mr. Adams. You will greatly oblige me if you will do what is in your power to ship what is required with the least possible delay,

Thanking you in advance, I am

Sincerely yours,

The Gerlach,

New York City, March 27, 1895

Mr. Albert Schmid,

Pittsburgh, Pa.

My dear Mr. Schmid,

You will remember that some time ago I wrote to you that I was going to want some of your annealed converter iron strips. I have now decided as to their size. They are to be two and five-eights (2 5/8) inches wide and eleven and five-eights (11 5/8) inches long. As to thickness, please use the same as on your converters found most practical to considering performance and cost, etc.

I assure that these strips will be readily obtained without much delay, and as they will be punched they will be of uniform size. You will add to my obligations if you will kindly see that these strips are of the best quality of iron (or steel) and annealed most carefully, as shipped with the least possible delay to my address above. I want enough of these strips to make up a weight of one thousand (1000) pounds.

Kindly let me know upon receipt of this letter when I may expect these strips. As the time is pressing I would beg you to forward them by express at my expense.

Hoping that you will oblige me by attending to this matter at once, I am sincerely yours,

The Gerlach,

New York City, March 30th, 1895

Mr. Albert Schmid,

Pittsburgh, Pa.

My dear Mr. Schmid: -

I have to thank you for your kind letter of March 27th. I may be able to come out and have a talk with Mr. Bannister.

The other day I wrote you about some strips of annealed converter steel, and I am still anxiously awaiting your reply. Hoping that you have ordered the material, and that I shall get it without much delay, I am

Sincerely yours,

The Gerlach

New York City, March 30th, 1895

Mr. Albert Schmid,

Pittsburgh Pa.

My dear Mr. Schmid: -

Oblige me and let me know, immediately upon receipt of this, what is the smallest size rotating 2-phase transformer you have in stock. I would like to have about 25 cycles a second, as adopted in Niagara. The commutator should be one possessing a great number of bars, so that I can get a continuous current which I want for some purposes in the laboratory.

I would prefer such a machine to one which has got only few commutator segments, and in which the current in necessarily undulating.

I propose to use a machine of the above description and capacity about 25 H. P. or so, for driving motors, and what little machinery I want in the electrical department of my shop. I have provided steam-power for my work-shop.

You will add to my obligations if you let me know what motors I could get to go together with that machine.

The tension should be from 125 volt upward to no more than 220 volt. Furthermore I am not limited exactly to the capacity, and it might be something more than 25 H. P., but not very much more.

Hoping I receive from you an early and favorable reply, and thanking you in advance, I am

Cincerely yours,

The Gerlach

New York City, April 1st, 1895

Mr. Albert Schmid,

Pittsburgh, Pa.

My dear Mr. Schmid: -

Your letter of March 28th received. I am much obliged for your kindness in attending to the matter at once, and would only remind you not to send the strips by freight, but by express at my expense, and please also advise me by dispatch of the shipment.

Yours sincerely,

The Gerlach,

New York City, April 3rd, 1895

Mr. Albert Schmid,

Pittsburgh, Pa.

My dear Mr. Schmid: -

Many thanks for your kind letter. I have made up my mind to purchase a machine of the kind you refer to. I have written a letter to Mr. Bannister, and would beg you please confer with him without delay. I can assure you that I shall be grateful for your help. The machine should be wound for 220 volts and should give 3200 alternations per minute, and I shall but later on motors also wound for 230 volts. About these motors I shall write later on, as I inter that there would be not much delaying in getting them. The capacity of the machine x should be about 30 H. P., but may be 25 if you like, and it is very important for me to get it as soon as possible, as much of my work is being delayed. As I intent to use this machine for certain specific purposes in connection with my oscillators, a high efficiency figure is an important item. Please, therefore, do not spare any pains or expense to secure the best result. I shall rely, as to the price, entirely on the fairness of the Westinghouse Company. I believe that there are gentlemen in that company who believe in a hereafter.

You mention in your letter that it would want six weeks to furnish the machine. Should you find any way of shortening this by selection of patterns existing I would be much obliged to you for doing it. But I would want, as I stated before, the best workmanship, and the best results which are within the reach of your ability and experience.

Kindly advise me whether this is understood, and whether you are going on with the work.

With kind regards, I am

Sincerely yours,

The Gerlach,

New Yok City, April 4th, 1895

Mr. Albert Schmid,

Pittsburgh, Pa.

My dear Mr. Schmid: -

I have just received dispatch advising me of the shipment of 412 pounds of iron strips, as ordered. Please accept my best thanks for your kindness in attending to this small affair.

Sincerely yours,

The Gerlach,

New York City, April 6th, 1895

Mr. Albert Schmid,

Pittsburgh, Pa.

My dear Mr. Schmid: -

Your dispatch of yesterday, relating to the high-tension converters, received. I shall write you about this matter Monday, as I have to suggest some improvements on the converters you have made before. These, however, will not involve any loss of time.

Thanking you for your attention in replying, I am

Sincerely yours,

Westinghouse Electric & Manufacturing Company

120 Broadway

NEW YORK, N. Y., April 8th, 1895

Nikola Tesla, Esq.,

The Gerlach,

New York City.

Dear Mr. Tesla:

I am in receipt to-day of our letter of the 3rd inst. And have instructed Pittsburgh to prepare and ship the rotating two-phase transformer described by Mr. Schmid. The order will receive our best attention, and when I get the data it will give me pleasure to make the price as low as we possibly can.

I have regretted every time I have thought of your misfortune that should have met with such a loss. I am very glad to know that you took your coat and went to work again to get everything back into shape as soon as possible.

I expect to be in New York several days and shall hope to have the pleasure of seeing you.

Yours truly,

Lemuel Bannister

Vice President & General Manager.

The Gerlach,

New York City, April 9, 1895

Mr. Albert Schmid,

Pittsburgh, Pa.

My dear Mr. Schmid: -

Your dispatch, advising me of the shipment of the balance of the iron strips, received. I have also received a letter from Mr. Bannister, in which he informs me that the order for the rotary transformer is put through the shop. You will greatly oblige me if you will push the work on that transformer, and make it excellent in every way, as it is likely that I shall exhibit it in connection with my oscillators.

Mr. Stillwell told me the other day that you have shipped to my address two rotating field rings which were exhibited at the World's Fair. I am very anxious to get them, but as I have, as yet, not received anything, I am afraid that they are somewhere at the railroad station. Kindly look into the matter and trace them.

Thanking you again, I am

Sincerely yours,

46, E. Houston St.,

New York City, April 12, 1895

Westinghouse Electric Co.,

Pittsburgh, Pa.

Gentlemen: -

The iron strips you have forwarded have been received. I thank you for your prompt delivery, and would beg you to forward the bill soon.

Very truly yours,

46, E. Houston St.,

New York City, April 12th, 1895

Mr. W. C. Clark,

Pittsburgh, Pa.

My dear Sir: -

Your favor of April 10th is received. I thank you very much for your kindness in writing me, and attending to the matter.

Very truly yours,

N. Tesla

New York City,

46, E. Houston St., April 13th, 1895.

Westinghouse Electric Co.,

Pittsburgh, Pa.

Gentlemen: -

Please forward, with the least possible delay, three small, direct-current motors, viz., one H. P., one-half H. P., and one-quarter H. P. All three motors must be wound for 220 volt circuit.

Hoping your will favor me with an early shipment of this apparatus, I am

Very truly yours,

46, E. Houston St.,

New York City, April 13th, 1895

Mr. Albert Schmid,

Pittsburgh, Pa.

My dear Mr. Schmid: -

I was just written to the Westinghouse Company about three small direct-current motors, viz., one H. P., one-half H. P. and one-quarter H. P., all wound for 220 volts.

Please oblige me and let me have these at once, as I need them temporarily in the shop, where I have at present only the direct current from the central station.

Sincerely yours,

46, E. Houston St.,

New York City, April 13th, 1895.

Mr. George Westinghouse, Jr.,

New Youk City.

Dear Mr. Westinghouse: -

Since some time, my friend, Hubert Vos, the great portrait painter has been sojourning in this city. I have very often spoken to him about you, and I feel that he has an idea of your personality such as would enable him to make of you a portrait which would be a valuable addition to the art.

I suppose that, under the pressure of your many engagements, you have not, as yet, found moments of leisure to devote such a purpose and, thinking that you might feel that it is in a certain measure your duty to do so, I would call your attention to this favorable opportunity.

Very truly yours,

New York City,

46, E. Houston St., April 16th, 1895

Westinghouse Electric Co.,

Pittsburgh, Pa.

Gentlemen: -

I beg to acknowledge the receipt of your favor of April 15th, and wish to thank you for your prompt reply.

As you have no small motors, I shall have to get along with what you can furnish. Please forward, as soon as possible, one one H. P. motor, 1900 revolutions, wound for 220 volt circuit, and one ¾ H. P. motor for the same circuit and 1300 revolutions per minute.

I imply that the later motor is really a one H. P. motor in disguise, and I expect that these two motors will be sufficient for my present purposes.

Kindly oblige me by a speedy delivery.

Thanking you in advance, I am

Very truly yours,

46, E. Houston St.,

New York City, April 20th, 1895

Westinghouse Electric Co.,

Pittsburgh, Pa.

Gentlemen: -

I beg to acknowledge the receipt of the two rotating-field rings which were exhibited at the World's Fair. Please accept my best thanks for your kindness in giving me this apparatus, to which I attach now a special value, since most of the objects which were dear to me have been destroyed.

Very truly yours,

46, E. Houston St.,

New York City, April 23, 1895

Mr. Albert Schmid,

Pittsburgh, Pa.

My dear Mr. Schmid: -

Some time ago you will remember I wrote you about some high-tension converters which I needed in the pursuance of investigations, since the old ones have been destroyed.

Upon receiving the high-tension converters from the World's Fair, I found that one of them was injured. I was then obliged to take it out and repair it, and on that occasion I noted certain defects which I have tried to remedy in the design which I have mailed to you this day.

I have no doubt that the drawing will be clear enough for you to save all description. I would only remark that in making up the secondary spools I have assumed that you will use fiber washers riveted together by small brass rivets. These washers I suppose you can make up of small pieces, so that they would not involve the cutting up of large fiber sheets, but I do not want you to spare a few dollars on my account. In the center of the iron core I have found it indispensable to put a brass bolt as indicated in the drawing, and furthermore to place iron strips in front of the ends of the core. These strips I need for several reasons.

I would beg you to instruct Mr. Kaiser to wind these secondaries most carefully and try to place exactly 100 turns of wire #26 on each layer. On the ends of each layer wind string of slightly larger diameter than the insulated wire, so there will be a tendency for the paper that is placed between the layers to bulge up on the ends. This paper I calculated to be very nearly 1/64 inch thick.

The ends of the secondary ought to finish as indicated in a and b. Of course I count that you will put fewer turns on the last layer, and then wind thick and stranded wire on the top to protect the finer wire.

Each half of the primary will have four ends, as the winding is made by two wires insulated from each other. There should be, then, eight binding-posts for the primary.

Please oblige me by a reply whether everything is understood, and begin the work without delay.

I shall be very much obliged for your personal attention, and for any services that may render me in the connection.

Very sincerely yours,

46, E. Houston St.,

New York City, April 24th, 1895

Mr. Albert Schmid,

Pittsburgh, Pa.

My Dear Mr. Schmid: -

In writing you yesterday about the high-tension converter, I forgot to mention that I would prefer to place the iron tank, which should be very strong, on a small truck fitted for that purpose, so that it can be readily moved.

You need not cover the iron tank with the boards, as you did on the old apparatus, as this simply increases the weight and cost.

In side I have shown the wood, which of course should be the driest pattern wood, filling as much space around the coil as possible, so as to reduce the amount of oil to the minimum. Besides saving there is an advantage of the coil being lighter and safer. Please therefore, instruct the carpenter to cut of the pieces so as to fit everywhere around the coils to a distance of about ¾ of an inch, which I consider minimum. You may also place a board between the two secondary spools at a distance of ¾ of an inch from each.

Please remember, also, that when winding the secondary I would under no circumstances use shellac or any other varnish, but some light oil, as paraffine oil, which will be brushed over each layer when it is finished. Do not use liniseed oil, as the coil might get hot during the winding.

You will greatly oblige me if you will send me a dispatch upon receipt of this, that you have my sketch, and that you are proceeding with the work.

Hoping to hear from you shortly, also, in regard to the rotating transformer which I have ordered, favorable news, I am

Sincerely yours,

46, E. Houston St.,

New York City, April 25th, 1895

Mr. C. F. Scott,

Pittsburgh, Pa.

My dear Mr. Scott: -

I have written to the Westinghouse Company about a high-tension converter of a somewhat modified design, which is intended to replace the old converters constructed for the World's Fair.

Although I know that Mr. Schmid will do for me as much as he can, yet fearing that he may be too busy, or away from the factory, I write this to ask if you would not kindly devote a little attention to this small matter. I shall be very much obliged to if you will see that I get at least one of the two converters very soon. I hope also that you may be able to advance the construction of the rotating transformer which I have ordered some time ago. My work has been suddenly interrupted just I was at the most interesting stage of the development of certain ideas, and I need very much my apparatus to begin work anew.

Thanking you in advance for any service in this connection, I am

Sincerely yours,

46, E. Houston St.,

New York City, April 26th, 1895.

Mr. Albert Schmid,

Pittsburgh, Pa.

My dear Mr. Schmid: -

Your dispatch of yesterday received.

Please accept my thanks for the prompt action. I hope that the construction of the rotating transformer is favorably progressing.

Yours sincerely,

46, E. Houston St.,

New York City, May 3rd, 1895.

Westinghouse Electric Co.,

Pittsburgh, Pa.

Gentlemen: -

I wish to acknowledge the receipt of goods as per statement forwarded to me together with your favor of April 30th, Viz., One 1 H. P. Shunt Wound, 220 Volt Motor; One ¾ H. P. Shunt Wound Motor, with belt tightener slides, Two Rheostats and a pulley.

The blue-prints showing the diagrams of connections have also been received under separate cover.

Thank you for the speedy delivery, I am

Very truly yours,

46, E. Houston St.,

New York City, May 3rd 1895.

Mr. Albert Schmid,

Pittsburgh, Pa.

My dear Mr. Schmid: -

I would be much obliged if you kindly let me know how the work on the rotating transformer is progressing, and when you will expect to be able to ship it.

Very sincerely yours,

46, E. Houston St.,

New York City, May 4th, 1895.

Mr. C. F. Scott,

Pittsburgh, Pa.

My dear Mr. Scott: -

Thanks for your letter of May 3rd, which I have just received.

I hardly need to assure again, on this occasion, that I shall be very much obliged for any trouble you take in advancing the work on my apparatus.

I am particularly anxious about the rotating transformer, as I have not heard anything since some time in regard to it.

Yours very truly,

46, E. Houston St.,

New York City, May 9th, 1895.

Mr. C. F. Scott,

Pittsburgh, Pa.

Dear Mr. Scott: -

Thanks for the favorable report in regard to the rotating transformer. I would not bother you with this matter knowing you are doing all in your power to advance the work, were it not that I am so very anxious to begin anew my interrupted experiments. This kind of work is almost essential to my health, and I hope that its resumption will have a good effect upon me.

Sincerely yours,

46, E. Houston St.,

New York City, May 9th, 1895

Westinghouse Electric Company,

Pittsburgh, Pa.,

Mr. Albert Schmid, Supt.

Dear Mr. Schmid: -

When I ordered the 30 H. P. rotating transformer, I implied that a starting-box will go with it.

I have, not, in my laboratory, the direct current from the city mains, and will require a box to start the transformer. You may have a box ready, and if not kindly have one made for the purpose, and shipped with the transformer or before.

Very truly yours,

46, E. Houston St.,

New York City, May 14th, 1895

Mr. C. F. Scott, Electrician,

Westinghouse Electric Co.,

Pittsburgh, Pa.

Dear Sir: -

Your favor of May 11th just received. I know that you have extended experience in kindred matters, and that you will employ the best method of bringing out the terminals.

I would suggest, because of the convenience I would have, that you put on the top substantial binding-posts for the primary as for the secondary wire, so as to enable me to attach, even to the later a very heavy wire. The rubber columns, on the top of which the secondary binding posts are places, should be removable, so that they would not interfere with the boxing in case of shipment. The best way, it seems to me, would be to connect the secondary wire as deep in the tank as possible to two metal blocks, in to which metal rods covered with hard rubber would be screwed.

I have further to suggest that the tank be placed on a small truck with rollers, and there should be on each side ordinary iron handles for eventually lifting the whole.

Hoping that I shall get the coil soon, and thanking you for your attention and trouble taken in the matter, I am

Very truly yours,

46, E. Houston St.,

New York City, May 14th, 1895

Mr. Albert Schmid, Supt.,

Westinghouse Electric Co.,

Pittsburgh, Pa.

My dear Mr. Schmid: -

This will introduce to you, Mr. Johann Jordan, from Vienna, who desires to exploit here some improved carbons of his own manufacture, and for up other business, with the view of importing to Europe some American machinery or articles.

Any courtesy and service you may be able to render to Mr. Jordan will be appreciated by me.

Sincerely yours,

46, E. Houston St.,

New York City, May 15th, 1895.

Mr. W. C. Clark, Assist. Gen. Manager,

Westinghouse Electric Co.,

Pittsburgh, Pa.

Dear Sir: -

From your favor of May 14th, just received, I infer that Mr. Bannister is absent, and I take liberty to write to you, and say that, in my opinion, Captain de Khotinsky would be a very valuable addition to your staff, especially if the Westinghouse Company are engaged in any accumulator or electrolytic work, as he has extended experience in that direction.

Very truly yours,

N Tesla

46, E. Houston St.,

New York City, May 16th, 1895.

Mr. W. J. Longmore,

Westinghouse Electric Co.,

New York City.

My dear Sir: -

This will introduce you, Mr. Francis Jehl, who I have known for many years. I have a high opinion of Mr. Jehl's integrity in his business dealings, and am convinced that whatever you arrange with you, you have no cause to regret it.

Very truly yours,

46, E. Houston St.,

New York City, May 17th, 1895.

Mr. Albert Schmid, Supt.,

Westinghouse Electric Co.,

Pittsburgh, Pa.

My dear Mr. Schmid: -

I have received your favor of before yesterday, and would beg you, in constructing the rheostat, to allow plenty of wire capacity, as I would like to get a resistance box which not only would be convenient for starting the rotating transformer, but could be used also for other purposes, and in emergencies I would like to have as wide a range as possible.

Hoping that you will soon be able to ship the machine and apparatus ordered, I am

Sincerely yours,

46, E. Houston St.,

New York City, May 18th, 1895.

Mr. C. A. Bragg,

Westinghouse Electric Co.,

Philadelphia, Pa.

My dear Mr. Bragg: -

Your letter with inclosure received. I have now a greater faith than ever in your honesty, for the inclosures consisted of Government Bonds.

I am located at above address, and will be pleased to see you any time.

Very truly yours,

46, E. Houston St.,

New York City, May 21st, 1895.

Mr. Albert Schmid,

Westinghouse Electric Co.,

Pittsburgh, Pa.

My dear Mr. Schmid: -

Your dispatch just received. I am much obliged for your kindness and hope that there will be no unforseen delay in the shipment.

Yours sincerely,

46, E. Houston St.,

New York City, May 22nd, 1895.

Mr. Albert Schmid,

Westinghouse Electric Co.,

Pittsburgh, Pa.

My dear Mr. Schmid: -

Please mail, as soon as possible, upon receipt of this letter, the blue-prints of the rotating-field transformer, as I want to dimensions of the base.

Oblige me by an answer without delay.

Sincerely yours,

46, E. Houston St.,

New York City, May 28th, 1895.

Mr. Albert Schmid,

Westinghouse Electric Co.,

Pittsburgh, Pa.

My dear Mr. Schmid: -

Thanks for the blue-print of the foundation for my rotating transformer which I have just received together with your letter of May 24th.

I hope that you will be able to ship the machine, as promised in your last letter. I also anticipate the shipment of the high-tension transformer very shortly.

With thanks for your kindness, I am

Sincerely yours,

46, E. Houston St.,

New York City, May 29th, 1895.

Mr. Albert Schmid, Supt.,

Westinghouse Electric Co.,

Pittsburgh, Pa.

My dear Mr. Schmid: -

This will introduce you to Mr. J. J. Bellman, who is desirous of securing a position with an electric company. There is no need of my testifying to his qualities, as his certificate from the Columbia College will show. In engaging his services you will make a very valuable addition to your staff, and greatly oblige me,

Sincerely yours,

46, E. Houston St.,

New York City, June 6th, 1895.

Mr. Albert Schmid,

Westinghouse Electric Co.,

Pittsburgh, Pa.

My dear Mr. Schmid: -

Your dispatch of yesterday, for which I thank you, has been received. I am a little disappointed to learn that the shipment will not me made before Tuesday next. Knowing that there can be no mistake on any dynamo that you design, I consider the test a superfluous affair, and would suggest that you ship the machine directly. Please also take care that the apparatus is not unduly delayed on the railroad. I do not care for spending a few dollars more, provided I get it quicker.

Sincerely yours,

46, E. Houston St.,

New York City, June 10th, 1895.

Mr. Albert Schmid,

Westinghouse Electric Co.,

Pittsburgh, Pa.

My dear Mr. Schmid: -

Your dispatch of Saturday has reached me late in the afternoon. I thank you very much for the prompt attention to my letter, and hope that the machine has turned out entirely to your satisfaction, which means to say that it cannot be further improved.

You will add to my obligations if you inform me when you expect to ship my high-tension coil. It must be very well under way, judging for a letter which Mr. Scott wrote me some time ago. I hope also that you will be able to shop the starting-box together with the rotating-transformer.

Hoping to have soon the pleasure of seeing you, I am

Sincerely yours,

46, E. Houston St.,

New York City, June 13th, 1895.

Mr. Albert Schmid, Supt.,

Westinghouse Electric Co.,

Pittsburgh, Pa.

My dear Mr. Schmid: -

Your letter of June 12th has just reached me. I am very glad to learn that the generator has been shipped, and that I have now the prospect of soon continuing the line of experiment which was interrupted a few months ago. Kindly oblige me by forwarding as soon as ready, because it will be difficult for me to operate the motor without it.

I appreciate the use of German silver wires insuring constant resistance, and will value it the more if the bill turns out to be small. The later requirement is far more important for me than the constant resistance.

Hoping that the converter will be shipped at the time promised, and thanking you for your help, I am

Very sincerely yours,

46, E. Houston St.,

New York City, June 15th, 1895

Mr. George Westinghouse, Jr.,

New York City.

Noting your efforts to warn the public against infringements on my multiphase motor patents, I am prompted by a feeling a friendship to point out to you personally that your advertisements do not bring out clearly the fact that these patents cover not one, but a number of lines of almost equivalent importance in the practical introduction of the system, but rather make it appear to the uninformed that all is dependent upon a single feature. You can readily see that with a few words your statements may be rendered much stronger, and will more exactly express the state of things.

I would on this occasion call your attention to another point. A few years ago, when the advantages of my system were discussed by some experts, I dwelt on the fact that when a great number of motors and lamps and other devices is worked on the multiphase system the efficiency of the system as a whole must be higher than the average efficiency of a single motor. Since you have a large plant now in operation, the truth of my assertion may now be practically tested. If you will measure the steam consumption, you will necessarily find that the results are better than can be obtained with the direct current system, although it is quite possible that a single direct current motor might give a slightly better result than a single alternating motor.

Very truly yours,

46, E. Houston St.,

New York City, June 15th, 1895

Mr. Albert Schmid, Supt. Westinghouse Elec. Co.,

Pittsburgh, Pa.

My dear Mr. Schmid: -

Having not to this day, as yet, received the invoice of the rotating transformer, which you inform me you have shipped Monday last, presumably by freight, I would beg you to ship the regulating box as well as the high tension coil by express. I suppose that the weight of this apparatus will not be such as to make the shipment in this way expensive.

Thanking you in advance, I am

Sincerely yours,

Westinghouse Electric & Manufacturing Company

120 BROADWAY

NEW YORK, N. Y. June 18th, 1895.

N. Tesla, Esq.,

46 East Houston St., City.

Dear Mr. Tesla,

I have your favor of the 15th inst. which shall receive my best attention. I am obliged to you for writing to me on the subject. We are anxious to give as much prominence as possible to every feature in connection with your inventions.

Truly yours,

Geo. Westinghouse Jr.

46, E. Houston St.,

New York City, June 19th, 1895.

Mr. Albert Schmid, GENERAL (Supt.)

Westinghouse Electric Co.,

Pittsburgh, Pa.

My dear General: -

Our dispatch of yesterday, for which I am much obliged, was received, and I have since also received note of shipment. I unable to locate, as yet, the transformer; it seems to still be under way. In view of this I would beg you to always ship the goods, or make communications, except of a personal nature, to my laboratory, 46, East Houston Street.

Thanking you in advance, I am

Sincerely yours,

46, E. Houston St.,

New York City, June 20th, 1895.

Mr. Albert Schmid, Gen. Supt.,

Westinghouse Electric Co.,

Pittsburgh, Pa.

My dear Mr. Schmid: -

Your dispatch in regard to the converters has been handed to me this moment, and I have replied immediately by wire, asking you to shop the converters by express, in view of the long delay by freight. I am very disappointed for not have, as yet, obtain news of the rotating transfer, although it is now over ten days since, according to your letter, it was shipped.

With best thanks for your kindness, and anticipating the pleasure of seeing you soon, I am

Very sincerely yours,

46, E. Houston St.,

New York City, June 21st, 1895.

Mr. Albert Schmid, Gen. Supt.,

Westinghouse Electric Co.,

Pittsburgh, Pa.

My dear Mr. Schmid: -

The rotating transformer has been finally received, and I am very pleased by the first inspection of the machine, which shows you have bestowed upon it more than the usual care.

I shall be much obliged to you if you kindly send me blue-prints of the machine, and such particulars as you can give without departing from the usual practice of your company in kindred matters. I would like, of course, to know everything pertaining to the winding and the constants of the iron, so as to be able to profit by the experiments with this machine as soon as possible.

Hoping that the high tension apparatus will be received in good shape, I am

Yours very sincerely,

46, E. Houston St.,

New York City, June 22nd, 1895.

Mr. Albert Schmid, Gen. Supt.,

Westinghouse Electric Co.,

Pittsburgh, Pa.

My dear Mr. Schmid: -

I have run the motor yesterday, and was very pleased to note the great improvements you have made in these machines over those of two or three years ago. I have no doubt that it is highly efficient machine, judging from the quickness with which the speed regulation is effected. My idea was that you would ship a pulley together with the motor, as you do with generators. The best suitable size for me would be between 16 and 20 inches. I would like you would send on one which is very well balanced, of that size, or slightly larger.

Hoping to hear from you with return mail, I am

Sincerely yours,

46, E. Houston St.,

New York City, June 21st, 1895.

Mr. Albert Schmid, Gen. Supt.,

Westinghouse Electric Co.,

Pittsburgh, Pa.

My dear Mr. Schmid: -

I note from your letter of a few days ago that you have shipped the field regulating-box of the rotating transformer. As I have not yet received it, I would beg you to see whether it has been shipped with the transformer.

I am hopeful that you will be able to ship the starting-box very soon.

Yours sincerely,

46, E. Houston St.,

New York City, June 24th, 1895.

Mr. Albert Schmid, Gen. Supt.,

Westinghouse Electric Co.,

Pittsburgh, Pa.

My dear Mr. Schmid: -

Will you kindly forward, as speedily as possible, rings of sheet iron, 9-1/2 inches inside, and 11 inches outside diameter? The thickness of the sheet iron should be between 1/64 and 1/32 of an inch, or whatever thickness you use in your armatures. The iron should be of the highest quality and best annealed, and I shall want about 100 pounds of these plates.

Hoping that you will be good enough to personally order this material, I am

Yours sincerely,

46, E. Houston St.,

New York City, June 25th, 1895.

Mr. Albert Schmid, Gen. Supt.,

Westinghouse Electric Co.,

Pittsburgh, Pa.

My dear Mr. Schmid: -

I have just received the high tension converters, and would say that they are a considerable improvement over the old ones. I hope that you have yourself derived from the construction of these transformers useful experience.

Hoping that they will turn out as I expected, and thanking you for the trouble you have taken in attending to the matter, I am

Sincerely yours,

46, E. Houston St.,

New York City, June 26th, 1895.

Mr. Albert Schmid, Gen. Supt.,

Westinghouse Electric Co.,

Pittsburgh, Pa.

My dear Mr. Schmid: -

In examining the high tension converters which I have received yesterday, I find that a few mistakes have been made, which I will point out for no other reason beyond the desire to be useful to you.

I find that instead of the laminated iron as required in my first communication to you, there have been put flat bars of iron on the ends of the core. Furthermore there were no holes on the bottom nor on the sides provided for the oil to circulate. The middle connection of the two secondary coils should have been insulated by a rubber bushing or otherwise to prevent a break through, when by unevenly loading the terminals the coil becomes unbalanced. Another defect was that the coil was placed too low, but this I have easily remedied by placing a few boards underneath. Another oversight was made in tacking the ends of the high tension wire to the frame-work because you know that no matter how dry the wood is, it will conduct such a current of high tension and short-circuit the coil. The screws which fastened the ends of the secondaries to the terminal wires passing through the rubber columns should have been placed sideways, as they can easily fall out and disconnect, the way they are made. The primary wire should have been sunk into the wood, as required in my sketch, this being necessary so as to enable the inserting of the laminated iron plates opposite to the ends of the core.

Otherwise the coil seems to be made up excellently, and the parts well fastened to the frame. I consider the arrangement of the central wood plate with the blocks on the sides to keep the secondary coils in position, a very good one.

You will oblige me in forwarding the exact particulars which relate to these coils, and I shall let you know immediately after testing them, how far they meet the requirements.

Hoping that you will not take these remarks as an adverse criticism, and thanking you again for your kindness, I am

Sincerely yours,

46, E. Houston St.,

New York City, June 29th, 1895.

Mr. Albert Schmid, Gen. Supt.,

Westinghouse Electric Co.,

Pittsburgh, Pa.

My dear Mr. Schmid: -

Your letter of June 28th has been received, and I thank you for the information contained therein.

In examining further the coils, I found that a more serious defect was present, which, however it was easy to remedy. If I mention this you will, of course, know that it is done with the most friendly motives.

I found that on the secondary ends which were connected in the middle above the primary, there were two brass plates fastened one inch and a half long and about ¼ inch wide. These brass plates should have been placed tangentially to the coil. Instead of this they were placed radially and over ¼ inch beyond the first secondary layer. As the whole secondary wire takes up 5 inches the brass pieces were thus made to span from 60 to 70 layers, and this defect was still further increased by the screws protruding a good depth into the fiber. In case of a superimposed vibration in the secondary, there might be easily 100,000 volts between the layers spanned by the brass plate, and the coil would surely break down. The fact in that the old coils broke down in this way, and I was particularly informing you in this regard, but forgot to mention it when I ordered the present coils.

I have placed the laminated iron, and have soldered the ends of the secondary in the middle, doing away with the two brass plates, because they were unnecessary and could only cause trouble.

I was pleased, in examining the coils, that the wood frame was excellently made up, and everything seemed otherwise in perfect shape, and it was quite evident to me that you had taken great care in constructing these coils.

With many thanks, I am

Yours sincerely,

46., Houston St.,

New York City, July 2nd, 1895

Mr. Albert Schmid, Gen. Supt.,

Westinghouse Electric Co.,

Pittsburgh, Pa.

My dear Mr. Schmid: -

You will perhaps remember that last Fall I took the liberty of recommending to you, through a letter, Mr. Emile Smith. He is a graduate from college, and has had some practical experience in mechanical and electrical engineering.

You know that I do not often recommend people, but the good opinion that I have of Mr. Smith prompts me to once more write and ask you whether you might not be able to give him a position at present in some of your factories. If you do so you will oblige me.

Sincerely yours,

46., Houston St.,

New York City, July 3nd, 1895

Mr. Albert Schmid, Gen. Supt.,

Westinghouse Electric Co.,

Pittsburgh, Pa.

My dear Mr. Schmid: -

I have just received the blue-prints pertaining to the 30 H. P. rotating transformer, and wish to thank you for them. The german silver wire resistance box for starting the transformer has not yet been received, but I presume that it is shipped or if not, that it will shortly be forwarded. I have received the box for the field regulation.

In some of my tests, I would like to run the transformer up to about 1200 revolutions per minute; this would be 50% higher than the normal speed. I am convinced that there would be no danger whatever, judging from the general aspect of the machine, but I would beg you to let me know whether you consider such running safe.

Anticipating an early reply, I am

Very sincerely yours,

46., Houston St.,

New York City, July 10th, 1895

Mr. Albert Schmid, Gen. Supt.,

Westinghouse Electric Co.,

Pittsburgh, Pa.

My dear Mr. Schmid: -

Will you kindly forward to my above address, six dozen large binding-posts which you usually put on your apparatus? I want about the size that you put on the rotary transformer.

Anticipating an early reply, I am

Yours sincerely,

46., Houston St.,

New York City, July 10th, 1895

Mr. Albert Schmid, Gen. Supt.,

Westinghouse Electric Co.,

Pittsburgh, Pa.

My dear Mr. Schmid: -

Your favor of July 8th received.

I can only say in favor of Mr. Smith, that his name resembles yours, and to his disadvantage that he resembles me. I hope that the latter will be not a serious objection, and would also beg you to remember that still waters are deep.

Hoping that you will be able to something for him, I am

Sincerely yours,

46., Houston St.,

New York City, July 11nd, 1895

Mr. Albert Schmid, Gen. Supt.,

Westinghouse Electric Co.,

Pittsburgh, Pa.

My dear Mr. Schmid: -

Your favor of July 20th received, from which I learn with pleasure that the starting-box will be shipped this day.

In my letter to you yesterday, I asked you to forward six dozen of your binding-posts, and would here repeat that you will oblige me by sending them without delay.

In addition to these binding-posts I would like to get some of your single and double switches because I can get them cheaper from you than from the supply house here. Kindly forward half a dozen double switches and half a dozen single. The later ones should be, roughly, for about 50 amperes, and the former for about 100 amperes in each circuit.

For some contrivances which I am driving with the alternating current I require a couple of small alternating motors. The best size for me would be about ¼ of a H. P., two-phase, and about 1/8 of a H. P. single phase induction motor, if you have such one on hand. The E.M.F. is immaterial; I presume that you wind them for 100 or 50 volts.

Should these sizes not be on hand, please let me have the nearest to it.

Hoping you will have the kindness to attend to this matter, I am

Yours sincerely,

46., Houston St.,

New York City, July 12nd, 1895

Mr. Albert Schmid, Gen. Supt.,

Westinghouse Electric Co.,

Pittsburgh, Pa.

My dear Mr. Schmid: -

Your letter of July 11th received. I meant the kind of binding-posts which you usually put on your dynamos. I thought that you have a large number of these binding-posts in stock, as you are constantly using them, and I would wish the large size. Anything that you select will be suitable for me. I would make them up it my shop, but I cannot spare the time, as I must keep my men on more important work.

Hoping that you will be able to find something which will do for my purpose, and thanking you, I am

Yours sincerely,

46., Houston St.,

New York City, July 24th, 1895

Mr. Albert Schmid, Gen. Supt.,

Westinghouse Electric Co.,

Pittsburgh, Pa.

My dear Mr. Schmid: -

Your letter and blue-print for binding-posts received. Kindly excuse delay in answering, which was caused by some derangements in my office.

I have taken the liberty of cutting out the print of the binding-post I shall require from your sample sheet. You will greatly oblige me if you will forward six dozen of these binding-posts at your earliest opportunity.

I have not, as yet, received the motors and switches about which I have written you before. I anticipate that they have been forwarded in accordance with your promise. Thanking you for your kindness, I am

Yours sincerely,

46., Houston St.,

New York City, July 26th, 1895

Mr. Albert Schmid, Gen. Supt.,

Westinghouse Electric Co.,

Pittsburgh, Pa.

My dear Mr. Schmid: -

Your letter of July 25th has just reached me. I have wired in reply as follow: "Please forward binding-posts single, not mounted in pairs. Oblige by shipment without delay by express."

I hope that you will be able to ship these binding-posts this week, as I want them; and also that the ½ H. P. motors have been forwarded in accordance with your letter.

Yours very sincerely,

46., E. Houston St.,

New York City, August 7th, 1895

Mr. George Westinghouse, Jr.,

New York City.

My dear Mr. Westinghouse: -

I learn from the journals of your friendly agreement with the Baldwin Locomotive Works. Foreseeing the electrical railroad development, I have often thought on the advantages of such a co-operation, and long time ago I had in mind to speak to you about it. The news of your consolidation has been an agreeable surprise for me. Such a splendid union of means and abilities cannot fail to be of interest to both parties concerned.

Yours very truly,

Westinghouse Electric & Manufacturing Company

120 BROADWAY

NEW YORK, N. Y. August 8th, 1895.

N. Tesla, Esq.,

No. 46 East Houston St.,

N. Y. City.

Dear Mr. Tesla:

I am much obliged to you for your letter of August 7th. It is another indication of the interest you have taken in the Westinghouse Electric and Manufacturing Co. We all think that the business arrangement entered into with the Baldwin people will be productive of good results.

I hope the time is not far distant when you will feel that you can make a visit to our new works at Pittsburgh to observe the operation of your motors in daily practice as well as to get a comprehension of our facilities.

Very truly yours,

Geo. Westinghouse Jr.

President.

46., E. Houston St.,

New York City, August 14th, 1895

Mr. George Westinghouse,

New York City.

Dear Mr. Westinghouse: -

Professor L. B. Atkinson of the South Wales Institute of Engineers, has written me a letter asking for some data of tests with alternate current motors. I believe that he is prompted by friendly motives and would make fair statements. If you are inclined to have anything published, it would be well to do it through him. Perhaps you intend to send some motors to England, and in such event their performance will have to be announced.

You will oblige me if you will remember Professor Atkinson on any future occasion of this kind, but of course I do not wish to influence you decision in any other way.

Yours sincerely,

GEO. WESTINGHOUSE, JR.

PITTSBURGH, PA.

August 15th, 1895.

N. Tesla, Esq.,

46 E. Houston Street, New York.

Dear Mr. Tesla: -

I have your favor of the 14th, and will send it to the office at East Pittsburgh so that our people there may deal with the matter according to your wishes.

Very truly yours,

Geo. Westinghouse Jr.

Westinghouse Electric & Manufacturing Company

Pittsburgh, Pa.

Sept. 4th, 1895

Mr. Nikola Tesla

New York City.

Dear Sir: -

This letter will be handed to you by Mr. Cleveland Moffat, concerning whom you have already a letter signed by Mr. Bannister and sent through the mails by mistake.

Yours truly,

Westinghouse Electric & Mfg. Co.,

J. F. Tener

Private Secretary

Westinghouse Electric & Manufacturing Company

Pittsburg, Pa.

October 11th, 1895

Nikola Tesla, Esq.,

The Gerlach, New York City,

Dear Sir: -

Last July there was a young man by the name of Emil Smith who came to us with letters of recommendation from you. He was put to work in the factory about the middle of last month was taken ill with Typhoid fever. He went to the Homeopathic Hospital in this city but did not get any better. Last Saturday they telegraphed for his relatives. His sister and a lady friend came on, arriving Sunday, and stayed with him until he died yesterday (Thursday afternoon at 2 P. M.).

I took charge of matters and any of the embalming of his body &c, forwarding same on 8 o'clock train last night to Detroit. The remains were accompanied by Miss Smith and Mrs. Leitner.

As he was a personal friend of yours I thought perhaps you be interested in hearing of his death.

Yours very truly,

H.F. Henry Floy

Westinghouse Electric & Manufacturing Company

Pittsburg, Pa.

December 16th, 1895

Mr. Nikola Tesla,

The Gerlach,

New York.

Dear Sir,

I am sending you under another cover a set of circulars describing our apparatus. The publication of this series of circulars was undertaken a few months since, and you will note that a number of them describe machinery which we have been manufacturing for a number of years. We send also one of the flexible covers provided for filing purposes, and our Mr. Dickson will see that a copy of each additional circular is mailed to you from time to time as issued.

I think you will be particularly interested in circulars Nos. 3 and 10, and if you have any criticism or suggestion we shall be most happy to receive it, and profit by it.

Very truly yours,

L. B. Stillwell

L.B.S./AD.

Westinghouse Electric & Manufacturing Company

Pittsburg, Pa.

December 24th, 1895

Mr. Nikola Tesla,

#46 & 48 East Houston st., New York City,

My dear Sir: -

Your very kind letter of December 19th is duly received, and I highly appreciate your willingness to assist us by allowing the use of your name and photograph. I showed your letter to Mr. Westinghouse, and he expressed his gratitifaction.

Upon thinking the matter over, however, and looking at it rather from your standpoint, I concluded that before carrying out my plan for an advertisement in Cassier's, it would be wise to have a talk with you, and possibly with Mr. Adams, in order that there might be no possible misunderstanding or dissatisfaction. I have thereforedeferred the advertisement and so notified the Cassier Magazine Co.

Again thanking you for your courtesy, I am

Yours very truly,

L. B. Stillwall,

Electrical Engr. & Asst. Mgr.

Westinghouse Electric & Manufacturing Company

Pittsburg, Pa.

December 26th, 1895

Nichola Tesla, Esq.,
46 East Houston St.,
New York, N. Y.

Dear Sir: --

Referring to your order of July 17th, beg to advise that we have the half-horse power, single phase, A. C. motor ready for shipment. Kindly advise us, if shall ship by freight or express.

Yours very truly,

WESTINGHOUSE ELECTRIC & MFG. CO.

By D. Carlington

Westinghouse Electric & Manufacturing Company

Pittsburg, Pa.

December 23, 1895

Albert Schmid,
General Superintendent

Mr. Nikola Tesla,

The Gerlach,

New York, N. Y.

My Dear Mr. Tesla: ---

I have arranged to go abroad on the end of 22d of January, and expect to make an extended tour through Europe. I shall visit Italy, France, Germany, Austria, Switzerland, England, etc., and would consider it a great favor if you would forward me, at your earliest convenience, letters of introduction to firms like the Ganz people, Scheider & Company, Helios Company, and to some of the prominent electricans and engineers in the above countries; also Mr. Brown, of Switzerland. I shall see you before I sail.

With the best wishes of the Season, I remain,

Yours Very Truly,

Albert Schmid

A.S.

New York, Dec, 31rst, 1895

#46 & 48 E. Houston Str.

Westinghouse Electric Co.,

Pittsburgh, Pa.

Gentlemen: -

Your favor of Dec. 26th has reached me.

I am glad to learn that a half H. P. single phase A. C. motor is ready and wish to say, that I shall be obliged, if you will ship it with delay, as I need it very much.

Hoping to receive it in good order, I am,

Yours very truly,

New York, Dec. 31rst, 1895

#46 & 48 E. Houston Str.

Mr. Albert Schmidt,

Sup't Westinghouse Electric Co.,

Pittsburgh, Pa.

Dear Mr. Schmidt: -

Thanks for the digression of your good wishes, of which I was always sure.

Nothing will afford me greater pleasure than complying with your wish in the matter, and although you need letters, what-ever, for your work, of which you can be proud, is the best recommendation.

Anticipating the pleasure of seeing you soon, I am

Yours sincerely,

Westinghouse Electric & Manufacturing Company

120 BROADWAY,

New York, N. Y., February 20, 1896.

Nikola Tesla, Esq.,

46 E. Houston St.,

City.

Dear Sir: -

We would be pleased to have you use your influence to have Dr. Louis Duncan nominated for Presidency of the American Institute of Electrical Engineers for the coming year.

Yours truly,

WM. P. ZIMMERMANN,

Gen'l Eastern Agent.

New York, March 13, 1896.

#46 & 48 E. Houston Str.

Mr. P. D. Lange,

Sup't Westinghouse Co.,

Pittsburg, Pa.

My dear Mr. Lange: -

I have known Mr. O. A. Sandborgh for some time and think him to be a very good man in every particular.

He is an excellent draftsman and, as far as I can see, could make his way in any of the departments of your large works. I would be glad to give him a position in my own shop, if I had an opportunnity. You will greatly oblige me if you will do for him what you can, and I hope that you will every reason to be satisfied with his services, should you give him employment.

Yours sincerely,

Westinghouse Electric & Manufacturing Company

Pittsburg, Pa. March 18th, 1896

ADDRESS ALL COMMUNICATIONS
TO THE COMPANY.

Mr. Nikola Tesla,

The Gerlach,

New York.

My dear Sir,

I duly received on Saturday last your telegram asking us to extend courtesies to your friend Mr. Maurel, the singer. It would give us pleasure to receive a visit from Mr. Maurel, but up to the present writing he has not, to our knowledge, appeared in Pittsburg. Should he call upon us you may be sure that we shall be glad to give him our best attention, both because he is Mr. Maurel, and because you have requested it.

Very truly yours,

L. B. Stillwell

Elec. Engineer & Acct. Manager

LBS/AD.

New York, May 2nd, 1896

#46 & 48 E. Houston Str.

Mr. W. H. D. Lange,

Westinghouse Electric Co.,

Pittsburgh, Pa.

My dear Mr. Lange: -

This will introduce to you Mr. A. Pfeiffer, who has been highly recommended to me, and in whose ability and integrity I have great confidence. He has received an excellent training at Sheffield Scientific School and has, besides, done practical work.

If you will accord him an opportunity to convince you of his abilities I shall be much obliged.

Yours sincerely,

Westinghouse Electric & Manufacturing Company.

120 BROADWAY,

NEW YORK, N. Y. May 27th, 1896

Nikola Tesla, Esq.,

No. 46 East Houston St., City.

Dear Sir: -

Some time ago while I was engaged in some experimental work at East Pittsburgh Mr. Page sent me one of your original motor models which had been entrusted to him by you. In accordance with intructions received from Mr. Page yesterday I have just written Pittsburgh instructing them to ship by express to you at 46 East Houston St. When the same is received will you kindly acknowledge it?

Very truly yours,

Ralph D. Mershon

COPY.

E. d. Adams, Mills Building, New York.

Commodore Mellville has signified the seventeenth as a satisfactory day to leave for Pittsburg. The arrangement is to go from Washington via Philadelphia, where we will dine at club with T. N. Ely, of Penna, R. R., leaving for Pittsburgh 10:25 P.M., going to Niagara Falls Saturday night. Will this suit you and Mr. Tesla, to whom kindly send copy of this telegram. You and Mr. Tesla would leave New York on 4:30 P.M. train on 17th.

Geo. Westinghouse. July 10th, 1896

GEO. WESTINGHOUSE, JR.

PITTSBURGH, PA.

July 10, 1896.

Nikola Tesla, Esq.,

Care Mr. E. D. Adams, Mills Building, New York.

Dear Mr. Tesla: - Some two or three weeks ago I spoke to Mr. Adams with reference to a proposed visit of Commodore Mellville, of the Navy, to our Works at East Pittsburgh, and to Niagara Falls being particularly desirous of having the Navy Department become acquainted with the advantages of the multiphase system for all sorts of operations aboard war vessels. The Commodore was obliged to postpone the trip on account of the letting of contracts for some new war vessels, but he is now ready, and it is proposed to leave Philadelphia on Friday evening the 17th.

Mr. T. N. Ely, the Chief of Motive Power of the Penna R. R., who will go with us, has invited us to dine with him at the Philadelphia Club Friday evening.

I sent to Mr. Adams a telegram of which I enclose you a copy. You and Mr. Adams could leave New York on the 4:30 P.M. train, and we will meet you at the Broad Street Station, Philadelphia, and then join Mr. Ely for dinner.

I am looking forward with much pleasure to this trip, and trust it is going to be entirely convenient for you to make it.

Truly yours,

Geo. Westinghouse

Westinghouse Electric & Manufacturing Company.

120 BROADWAY,

NEW YORK, N. Y. July 23rd, 1896

Nikola Tesla, Esq.,

The Gerlach,

New York, N. Y.

My Dear Sir: -

I am sending you by express, a short piece of cable through which passed the first current generated in the plant of the Niagara Falls Power Co., at Niagara, April 16th, 1895.

We have furnished similar souvenirs to the Directors of the Cataract Construction Co., some of the officers of our own Company, to Commodore Melville and Mr. Habirshaw, and feeling that you are particularly interested, have much pleasure in fowarding one to you. Please accept this with the best compliments of the Westinghouse Company.

Our friend, Dr. Habirshaw, made the cable and can tell you all about it. Samples similarly insulated are subject to break down tests in our factory and in no case was ruptured by a potential of 45,000 volts (A. C.)

I am very sorry that I did not have the pleasure of personally showing you the Niagara plant, but with Mr. Adams and Mr. Rankine as guides, and your knowing of electrical apparatus, no feature of special interest could have been over-looked.

You may be interested to know that the Patent Office has allowed me a patent covering the principle elements of the organization of switch board apparatus, which I trust will be useful to the Westinghouse Company in securing additional orders for extension of the plant.

It was a great pleasure to see you in Pittsburgh and I trust that your next visit will not be so long delayed as was the last one.

Very truly yours,

L. B. Stillwell

New York, August 1rst, 1896.

#46 & 48 E. Houston Str.

Mr. H. D. Lange,

Sup't Westinghouse Electric Co.,

Pittsburg, Pa.

My dear Mr. Lange: -

Mr. Moulton has been recommended to me very highly. I have seen him and he has impressed me as a man having thorough knowledge of machines and usual experiences. It is my opinion that, if you would give him employment, you would be entirely satisfied with his services.

Yours very truly,

Inclosure.

Westinghouse Electric & Manufacturing Company.

Pittsburg, Pa. September 4. 1896

Mr. Nikola Tesla

New York City, N. Y.

Dear Sir:

I have taken the liberty to send you under separate cover a copy of my first novel, entitled “Helene”, and although I am not unmindful of the fact, that you a very busy man, I flatter myself, that you will be sufficiently interested in the book to do me the honor of accepting it.

Sincerely yours,

Ernest H. Heinrich

"HELENE."

A NOVEL

BY ERNEST H. HEINRICHS.

LIBRARY OF CONGRESS
COPYRIGHT.
JUL 6 1896
CITY OF WASHINGTON

NICHOLSON PRINT,
PITTSBURGH.

"HELENE."

CHAPTER I.

It was in 1849.

Several European countries had only recently emerged from a revolution, which, while it had been succesfully squelched—albeit not without some material benefit to the revolutionists; its immediate consequences left these countries still in a state of ferment. The dissatisfaction among the lower classes, which had been going on for many years, directed against all existing forms of government, had at last in 1848 broken out into an open revolt under conditions, undoubtedly very favorable to their cause.

There had been many revolutions in the old world before this, but they had been principally confined to French soil, in fact, as everyone knows, a revolution in France is a very common occurrence. In 1848, however, the staid and phlegmatic German was at last aroused to assert himself and demand some of the rights, which an overbearing aristocracy had monopolized for centuries. Students of the people of Germany and their history have often expressed wonder that a race so sturdy, so strong and so enlightened should not have long ago shaken off the oppressive yoke of a government, which had two kinds of law, one for the aristocracy and the other for the people. The explanation is contained in the simple words: "Loyalty to custom."

The German is of an eminently conservative nature. He may emigrate from the Fatherland, find a new home anywhere, but he will stick to the habits and manners of his forefathers for a long time to come. This fact is nowhere more strikingly illustrated than among the Germans in this country.

It was this loyalty to custom among the people, that worked in favor of the aristocracy in Germany and prevented the outbreak of a rebellion. The existence of cause for complaint had manifested itself many times and very plainly. The people had realized, years and years ago, the oppressive tyranny of the aristocracy, they had frequently smarted under the whip. Yet, because these conditions had

New York, January 3rd, 1897.

#46 & 48 E. Houston Str.

Westinghouse Electric & Manufacturing Co.,

Pittsburgh, Pa.

Gentlemen:

Would you be kind enough to forward some of your catalogues, relating to polyphase motors, to the following address: Dr. S. Kimura, Professor of Physics, Sendai, Koto Gakka, Japan.

I shall be much obliged for your attention and hope that eventually something to your interest may result from it.

Very truly yours,

New York, May 22nd, 1897.

#46 & 48 E. Houston Str.

Mr. S. F. Scott,

Electrician Westinghouse Elec. Co.,

Pittsburgh, Pa.

My dear Mr. Scott: -

I would herewith introduce to you Mr. J. Tachihara, who has arrived from Japan with a view of acquiring practical knowledge of electrical machinery, particularly of the long distance transmission of power.

Any help or courtesy extended to him with be very much appreciated by

Yours sincerely,

Westinghouse Electric & Manufacturing Company.

Pittsburg Agency

Pittsburg, Pa. May 28, 1897

Mr. Nicola Tesla

New York City, N. Y. (East Houston St.)

My dear Mr Tesla: -

One of my friends in charge of the Adams Mining property, an iron ore mine owned by the Rockafelter interests in Minnessota. They of course have a large number of operators and accidents are continually happening. They have a very progressive hospital and medical system in charge of a very capable physician, Dr. Moore by name. Dr. Moore wants to secure X-Ray apparatus which enable him in case of an accident to a man make a quick photograph of the injured parts, and from this determine as to the best method of procedure. If possible he would like to get a machine which would enable him to photograph through the hip with an exposure of five minutes. It is the writer's recollection that you are interested in the manufacture of such a machine. If my impression is correct will you kindly send me such circulars as you may have and advise me whether the pictures he desires are within the range of possibilities at the present stage of the art.

Thanking you in advance for your courtesy in this matter, I beg to remain,

Yours truly,

Arthur Hartwell

Westinghouse Electric & Manufacturing Company.

Pittsburg Agency

Pittsburg, Pa. June 5, 1897.

Mr. Nicola Tesla,

46 E. Houston St.,

New York, N. Y.

My dear Mr. Tesla,

I have your kind favor of the 3rd instant, for which please accept the writer's thanks. I have advised Dr. Moore to hold off in his purchase until your machinery is ready or the market. As soon as it is will you kindly send me some detailed information concerning the apparatus.

Thanking you for your courtesies in this matter, and particularly your kind invitation, which I have transmitted to Dr. Moore, I beg to remain,

Yours truly,

Arthur Hartwell

New York, June 9th, 1897

#46 & 48, E. Houston Str.

Mr. C. F. Scott: -

This letter will be presented to you by Mr. A. Ehnhardt, who is recommended to me highly by some European friends. Being an electrical engineer he is naturally such interested in inspecting your works, and I would be much obliged to you for any facility you may be able to afford him in his connection.

With kinds regards, I am

Yours sincerely,

Westinghouse Electric & Manufacturing Company

Pittsburg Agency

Pittsburg, Pa. June 15, 1897

Dear Mr. Tesla:

The enclosed from to-day, Leader, may probably afford you a few moments guilt amusement.

Yours Sincerely,

E. H. Heinrich

New York, June 19th, 1897.

#46 & 48 E. Houston Str.

Mr. R. H. Heinrichs,

Westinghouse Electric Co.,

Pittsburgh, Pa.

Dear Mr. Heinrichs: -

I am much obliged to you for your note of June 15th, which, with inclosed poem, I have received.

You will observe that practically at the same time an effort was made in France to kill President Faure. Although the later was a comparatively insignificant event you will not fail to be impressed with the singular co-incidence.

Yours sincerely,

Westinghouse Electric & Manufacturing Company

120 BROADWAY

NEW YORK, N. Y. June 21st, 1897.

Nikola Tesla, Esq.,

The Gerlach, 27th St. & B'way, City.

Dear Dr. Tesla –

Please accept my thanks for your letter of June 18th: I feel greatly indebted to you for the interest you have taken in this matter and have no doubt that what you said to Mr. Stewart has had great weight in turning the contract our way. It is most gratifying to us to be able to say that we have received both the Niagara Falls and Mesina Power contracts.

Very truly yours,

Geo. Westinghouse

New York, June 20th, 1897.

#46 & 48 E. Houston Str.

Mr. Charles F. Scott,

Westinghouse Electric Co.,

Pittsburgh, Pa.

My dear Mr. Scott: -

This will introduce to you Mr. Kolomon von Kunde, chief engineer of a large electrical concern of Austria-Hungary, who is deserious of inspecting the Westinghouse works and also of meeting you personally.

I suppose that he would naturally receive from you all the courtesies due to him, and I only wish to any that I shall be much obliged for any facility you may be able to extend to him on his visit.

Yours sincerely,

ANNUAL REPORT

Of the Board of Directors of the Westinghouse Electric & Manufacturing Company to the Stockholders, June 23, 1897.

Board of Directors—Charles Francis Adams, Lemuel Bannister, August Belmont, N. W. Bumsted, A. M. Byers, Marcellus Hartley, George W. Hebard, Henry B. Hyde, Brayton Ives, George Westinghouse.

Officers—Chairman, Brayton Ives; President, George Westinghouse; First Vice-President, Lemuel Bannister; Second Vice-President, B. H. Warren; Third Vice-President and Treasurer, Ph. Ferd. Kobbe; Acting Vice-President, George W. Hebard; Secretary and Attorney, Charles A. Terry; Assistant Treasurer, Edwin S. Carpenter; Auditor, F. H. Ketchum.

To the Stockholders of the Westinghouse Electric & Manufacturing Company:

Your Board of Directors present herewith the balance sheet showing the financial condition of your company as of March 31, 1897.

Owing to the removal operations from the old into the new shops, your Board of Directors were unable to present a balance sheet for March 31, 1896, based upon actual values of inventories.

The class of electrical business conducted by your company has been in a depressed condition during the past two years, owing to the almost complete interruption in the building of new railways and new power stations. Notwithstanding these unfavorable conditions and the heavy charges to current expense account, due to the removal to the new works, and the making of new tools, patterns, etc., the company's earnings have exceeded the amount required for the dividends on the preferred stock, which have been promptly paid.

By comparing the present balance-sheet with that for March 31, 1895, it will be seen that there has been made a reduction in the surplus account of $1,577,735.93, due to amounts written off in connection with the dishandment of the old factories, the sale of obsolete tools, machinery and stock, depreciation of inventory, bad debts, the adjustment and settlement of old accounts, and the book loss from the sale of stocks and bonds owned by the company, and also the book loss resulting from the sale, at the price mentioned below, of $3,000,000, par value, of "Assenting Stock."

SALE OF ASSENTING STOCK.

On June 4, 1896, your company authorized the increase of its capital stock from $10,000,000 to $15,000,000, and your Board of Directors effected a sale of $3,000,000, par value, of the new assenting stock thus authorized to the Security Investing Company of Pittsburg, which realized to the company $2,489,000, of which amount $1,260,000 was received in cash, $329,000 was represented by patents and property, and the remaining $900,000 in interest-bearing notes secured by collateral; $300,000 of such notes were payable July 5, 1897, and have been paid; $300,000 are payable July 5, 1898, and the remaining $300,000 July 5, 1899.

EXPENDITURES FOR PATENTS.

Pursuant to the terms of the contract with the General Electric Company, for the exchange of licenses under the patents of the two companies, of which you were notified by a circular letter dated April 2, 1896, your company has purchased outright for $216,600 the Tesla patents for multiphase current motors, in order that both companies might manufacture apparatus covered by those patents without the payment of royalties other than those provided for in the agreement between the two companies. For like reasons your company purchased, for $72,231.17, the entire capital stock of the R. D. Nuttal Company, which has a complete workshop for its purposes and manufactures trolleys for the General Electric Company and your company, and gears and other railway supplies for the general market. The stock purchased is considered fully worth its par value of $118,000. Your company also purchased for $58,500, and the transfer of certain patents acquired through its agreement with the Security Investment Company, 12,433 shares of the Electro-Magnetic Traction Company, out of a total issue of 20,000 shares.

PATENTS.

The agreement between the General Electric Company and your company has been in force a little over a year, and the wisdom and value of the union of patents has been fully established. The patents of the two companies, thus brought together, have a commercial value which cannot be adequately appreciated by those not familiar with the electrical business. These patents are numbered by the thousand, and, within the field covered by the company's business, relate to every conceivable electric system and kind of apparatus to the minutest detail. Their present book value is less than the sum expended in acquiring and developing them. The terms of the contract between the General Electric Company and your company fix the respective values of the patents at 62½ per cent. for the General Electric Company and 37½ per cent. for your company. The patents owned by your company are carried at $4,689,080.89, or less than 37½ per cent. of the aggregate book value of the patents of both companies. Many of these patents have already been sustained by the courts, while in numerous instances infringers, after being made acquainted with the situation, have agreed to cease infringing.

During the past year many valuable patents have been acquired in the interest of the two companies at moderate cost, while the expense of carrying on suits has been greatly less than the sum formerly expended by the two companies.

A liberal course is being pursued in the enforcement of these valuable rights, and there is reason to expect that the time is near at hand when the patent property now being managed as a common interest will be generally recognized as exceeding in value and importance that of any other manufacturing interest.

STOCKS, BONDS AND PROPERTIES.

These items appear on the books at cost. It was the expectation of your Board of Directors that a large part of the bonds and stocks of lighting companies on hand could be disposed of from time to time, but there has been no market for the sale of such securities during the past two years. These stocks and bonds have as a rule increased in intrinsic value, and it is proposed to pursue the policy of selling them whenever advantageous terms can be secured.

It has not yet been possible to dispose of the old factories of your company and of the United States and Consolidated Companies. It is expected that with the improvement of business a market will be found for these properties.

It is the hope of your Board of Directors that the proceeds of the sale of stocks and bonds and old factories will, in the near future, be sufficient to care for the indebtedness of the company, leaving the quick assets for the regular current business.

POWER TRANSMISSION.

The utilization of water-power and its transmission by electricity have given great prominence to the Tesla patents, which, together with numerous other patents controlled by your company and the General Electric Company, should insure to the two companies the sale of all the power-transmission apparatus used in this country.

About two years ago your company installed at Niagara Falls, for the Cataract Construction Company, three 5,000 HP. generators, and in January of this year were awarded by that company the contract for five additional generators of the same capacity, which are now under construction.

Your company has also just been awarded a contract for fifteen 5,000 HP. generators by the St. Lawrence Power Company, which is the largest single order yet given for power-transmission apparatus.

Your company should derive great benefit from the execution of this contract, since no other company has yet attempted work of this size and importance. The securing of these contracts was, without doubt, due to the success of your apparatus at Niagara Falls and to the most complete facilities which your company now has at its new works at East Pittsburg for the manufacture of large electrical units.

RAILWAY DEVELOPMENT.

Your company has made marked progress in the development of apparatus for the operation of suburban and interurban trains on main railways, and it has installed at East Pittsburg, on the tracks of the Pennsylvania Railroad, experimental apparatus, where important experiments are constantly being carried on. We believe your company is now more fully equipped and has better facilities for work of this kind than any other concern.

WORKSHOPS.

Your workshops at East Pittsburg are in complete order, and have the advantages for manufacturing which it was contemplated they should possess. Its facilities, arrangements, machinery and tools enable it to undertake work of the largest character which may be proposed. All that has been said heretofore with reference to the property of your company at this place, and the opportunity it affords for economical operations, has been more than borne out by the facts. These works stand on your books at $2,769,886.26, of which $1,290,732.85 is for real estate and buildings, and $1,479,153.41 for machinery and tools, making an exceptionally low cost for works of such great capacity.

The engineers of your company have acquired a world-wide reputation in mechanical and electrical engineering, a fact well illustrated by the close copying by other manufacturers of plans, systems and designs which had their origin in your offices or works. The character of the apparatus turned out at your new works has given your company substantial trade advantages.

By order of the Board.

GEORGE WESTINGHOUSE, President.

Pittsburg, Pa., June 23, 1897.

WESTINGHOUSE ELECTRIC & MANUFACTURING CO.

BALANCE SHEET MARCH 31, 1897.

ASSETS:		
Cash in banks		$330,193.89
Bills receivable		43,207.09
Accounts receivable		1,604,517.19
Material in stock and in course of manufacture (at cost of labor and material)		1,636,612.33
Amounts advanced leased companies		569,766.56
Bonds (par value $1,395,094.79)		1,352,655.31
Stocks (par value $10,470,611.02)		4,612,223.87
Real estate and buildings, Pittsburg		455,115.71
New factory—land and buildings	$1,290,732.85	
Less—first mtg. on land & bldgs. (final payment due April 1, 1900)	$325,000.00	
First mtg. second purchase of land (due July 1, 1899)	59,300.00	
	384,300.00	
		906,432.85
Machinery and tools		1,479,153.41
Miscellaneous		286,306.40
Charters, franchises and patents		4,689,080.89
		$17,965,295.50
LIABILITIES:		
Accounts payable		$484,534.21
Bills payable, issued for merchandise		207,151.12
Discounted with collateral		1,399,506.89
Contract and Contingent Liabilities:		
Scrip dividend		194,560.00
Collateral trust bonds		590,000.00
U. S. E. L. Co.'s 6 % 15-year bonds, $50,000, payable annually		350,000.00
(Bills receivable under discount, $967,155.83.)		
Capital Stock:		
Preferred, 79,921.06 shares	$3,996,053.00	
Assenting, 161,962.52 "	8,195,126.00	
Common, 2,934 "	146,700.00	
		12,337,879.00
(In treasury 56,097.48 shares assenting, and 78.94 shares preferred.)		
Surplus		2,401,664.28
		$17,965,295.50

Westinghouse Electric & Manufacturing Company.

120 BROADWAY,

NEW YORK, N. Y. July 23rd, 1897:

Nikola Tesla, Esq.,

#46 East Houston St., City.

Dear Dr. Tesla: -

Accept my thanks for yours of the 22nd inst. enclosing letter from Mr. Sayers, copy of which I shall immediately forward to our London office with request that they give the matter prompt attention.

As requested, I return Mr. Sayers letter to you.

Yours truly,

Geo. Westinghouse

Enc.

Westinghouse Electric & Manufacturing Company.

120 BROADWAY,

NEW YORK, N. Y. July 26th, 1897

Nikola Tesla, Esq.,

No. 46 East Houston St., New York.

My dear Sir: -

A friend of mine writes asking whether you could care to lecture at the Music Hall of the Carnegie Library, Pittsburgh. This will not be a gratis job, and I think if you would care to lecture they would pay you the usual compensation, the amount of which I do not know but if you will consider the proposition I would be please to have you let me know and I will immediately put the proper party in communication with you. The question has been asked me and therefore I take the liberty of writing you with regard to same, so please not hesitate to do just as you feel. There is no obligation on my part, and I understand it, lectures given at this Hall are given for "revenue".

If you will kindly let me know your views on this subject I will be very much obliged.

Yours very truly,

Wm. F. Zimmermann

New York, Sep. 19th, 1897.

#46 & 48 E. Houston Str.

Mr. C. F. Scott,

Westinghouse Electric Co.,

Pittsburgh, Pa.

My dear Mr. Scott: -

I read in the electrical papers an article referring to a large induction motor recently installed in Niagara. Would you not be kind enough to give me some particulars for my personal information.

Yours sincerely,

Westinghouse Electric & Manufacturing Company

Pittsburg, Pa. Sept. 23rd, 1897.

SUBJECT – INDUCTION MOTOR.

Mr. Nickola Tesla

46-48 E. Houston St.,

New York City.

My dear Mr. Tesla: -

In reply to your note asking data regarding a large induction motor, I take pleasure in sending you several photographs and an out-line drawing giving the dimensions.

The primary winding consists of coils of thin copper strap. The motor is started by applying a low voltage received through transformers. The line current for starting at half of the full load torque is just about equal to the normal full load current, and the starting torque can be increased with corresponding increase in line current. The pulling out torque is over five or six times the normal full load torque. The power factor at half load is 91% and at full load is 96%. The efficiency is 90% at half load and 91% at full load.

The motor has a no-load speed of 375 revs. when running on a 3000 alternation circuit and the slip at full load is about 3%. The normal voltage on each of the two phases is 2200 volts. The maximum rise of temperature when carrying 500 H. P. is about 30 degrees C. The motor can readily carry 500 H. P. but is rated at 400 H. P. as the contract under which it was sold calls for a considerable overload capacity. Two of these motors have been made, the first of which has been in successful operation in the lighting station at Niagara Falls, driving the dynamos in the station, for the past month or so.

This is I believe the largest outgrowth of the induction motors on which we worked so energetically a number of years ago.

Yours very truly,

C.F.S. C. F. Scott

CHIEF ELECTRICIAN

New York, Sep. 24th, 1897.

#46 & 48 E. Houston Str.

Mr. C. F. Scott,

Westinghouse Electric Co.,

Pittsburgh, Pa.

My dear Mr. Scott: -

I have received your kind letter of Sep. 23rd together with the photographs and drawing of the 400 H. P. motor. Your valuable paper on the installation of Niagara Falls has also reached me and I have perused it with interest.

The results you give appear to me remarkable, and I see from them that you have not stopped working on these motors since I left them in your hands.

I look upon these results as particularly valuable inasmuch as they show that large machines of that type can be built and successfully operated.

Thanking you for the courtesies, I am,

Yours very truly,

New York, Oct. 15th, 1897.

#46 & 48 E. Houston Str.

Mr. George Westinghouse, Jr.

Lenox, Mass.

Dear Mr. Westinghouse: -

I have to ask a favor of you which, I hope, will be consistent with your interest to give without undue sacrifice.

A representative of my associate Schneider & Co., of Creuset, France, Mr. Auguste Boissonnas, is here and I have given him a formal letter of introduction to you. He is chiefly interested in the development of rapid electric traction, particularly, in alternating currents and their application to such use for long distance transmission, and I entertain the highest esteem for my associates and am most anxious to maintain friendly relations with them, I would neg you to facilitate to Mr. Boissonnas an inspection of your admirable works. You need not in the slightest aprehend that an advantage will be taken, for these people are of the highest standing, and if they would see anything that it would be to their interest to acquire, they would meet you in a loyal way.

Mr. Boissonnas, I understand him to say, will leave here Friday evening and might be in Pittsburgh Saturday or early next week. You would greatly oblige me if you would by telephone or otherwise issue directions that he be received in a friendly manner. That I am most anxious is to show the extensive and successful application of the polyphase system for a number of purposes.

Thanking you in advance, I am,

Your sincerely,

GEORGE WESTINGHOUSE.
ENGINE PARK. LENOX, MASS.

October 17th, 1897

Mr. Nicola Tesla,

46 & 48 East Houston Street,

New York.

Dear Mr. Tesla:

Your letter of the 15th came into my hands yesterday a little after four o'clock, on my arrival from Boston.

I am just telegraphing Mr. B. H. Warren, Vice Pres't of the Company, as follows:

"Mr. Tesla desires that we should give Mr. Auguste Boissonas, of Schneider and Co., Paris, an opportunity to fully observe the operation of the Tesla motors and of viewing our workshops. Kindly see him yourself and give him the desired facilities. Mr. Tesla expected him to be in Pittsburgh Saturday or early this week. Introduce Mr. Boissonas to Mr. Keller and to my brother."

And I feel assured that Mr. Boissonas will have the desired opportunity.

You will note from my telegram that I have asked Mr. Warren to introduce Mr. Boissonas to Mt. Keller, of the Westinghouse Machine Company where they are making a very wonderful gas engine, and to my brother, Mr. H. H. Westinghouse, Manager of the Air Brake Company.

If Mr. Boissonas has not already gone to Pittsburg, could you no go out and spend a day and half there with him? Unfortunately I am likely to be obliged to remain in the east all of next week.

Very truly yours,

Geo. Westinghouse

P. S. Will be in my office Tuesday.

Westinghouse Electric & Manufacturing Company

Pittsburg, Pa.

St. Louis Office, American Central Building

October 26, 1897

N. Tesla, Esp.,

#46 East Houston St.,

New York City.

Dear Mr. Tesla,

Your friend, Mr. Auguste Hoissonnas, called on me to-day, and I was very sorry that he was simply going through and I could not show him the various things he wanted to see. He expects to stop here again on his way home from Mexico, and I will then show him all there is in this city.

Yours very truly,

G Wautaleon

Westinghouse Electric & Manufacturing Company

Pittsburg Agency

Pittsburg, Pa. Dec., 3, 1897

Nikola Tesla, Esq.,

Hotel Gerlach,

New York, N. Y.

My Dear Tesla: -

I notice by the Pittsburg Papers, that you have been sick, but are now convalescing, and I take this opportunity to congratulate you upon this fact and hope that you will keep in the best of health as long as you yourself may wish.

Always, yours sincerely,

E. H. Heinrich

New York, Dec. 4th, 1897.

#46 & 48 E. Houston Str.

Mr. George Westinghouse, Jr.,

120 Broadway,

New York City.

Dear Mr. Westinghouse: -

Enclose letter just received from England, which might interest you. Kindly return it after perusal.

I shall write these parties to communicate with you in the matter.

Yours very truly,

GEO. WESTINGHOUSE.

PITTSBURGH, PA.

Dec. 7th, 1897.

Mr. NIKOLA TESLA,

c/o Tesla Electric Co., New York.

Dear Mr. Tesla: -

I have your favor of the 4th., enclosing a letter from Patterson, Cooper, & Co., of which I shall send a copy to our London house. I trust the matter will receive prompt attention, to the mutual advantage of all parties concerned.

Yours truly,

Geo. Westinghouse

New York, Dec. 14th, 1897.

#46 & 48 E. Houston Str.

Mr. E. H. Heinrichs,

Westinghouse Electric Co.,

Pittsburgh, Pa.

My dear Mr. Heinrich: -

Thanks for your evidence of your kind interest.

It is true that I have not been quite well of late, but can ensure you that I am physically and mentally allright at present. I have, however, still a little ailment which may be best designated financial anaemia, from which you yourself are suffering, if I am not mistaken.

I wish you would remember me to all the boys at about Christmas time, for it is just possible that some of them might feel disposed to send me a token.

Yours sincerely,

Westinghouse Electric & Manufacturing Company.

Pittsburg Agency

Pittsburg, Pa. Dec., 8, 1897

Nikola Tesla, Esq.,

New York, N. Y.

My Dear Mr. Tesla: -

Many thanks for your kind favor of the 4th inst.

While I am very glad to hear that you are physically and mentally in perfect condition, it grieves me very much to have to inform you, that you are ailing with what you choose to call "financial anaemia", still, as you say, there is consolation in knowing that you have many fellow suffers, your "humble servant", being one of them.

I shall remember your wish about speaking of you to the boys in Pittsburg and trust that some of them will feel disposed to send you a christmas rememberance.

With kindest regards, always,

Yours sincerely,

Ernest H. Heinrich

Westinghouse Electric & Manufacturing Company.

Pittsburg Agency

Pittsburg, Pa. January 3rd., 1898

Account.

Mr. Nikola Tesla,

#46 East Houston St.,

New York, N. Y.

Dear Sir: -

We enclose herewith statement of your account up to date, together with our receipt for the same, and the writer is instructed by Mr. Westinghouse to say that we have pleasure in sending you this receipt and that in so doing we quite appreciate the service you have from time to time rendered us in recommending our apparatus, in having interested customers in our behalf and in many ways materially assisting the interests of our Company.

With the best compliments of the season, we are

Yours very truly,

B. H. Warrell

Second Vice President

BHW

Enclosure

New York, Feb. 6th, 1898

#46 & 48 E. Houston Str.

Westinghouse Electric & Mfg. Co.,

Pittsburgh, Pa.

Gentlemen: -

I have not before this answered your kind letter of Jan 3rd, which, with inclosed statement was duly received, because I have daily expected that my affairs would bring me to Pittsburgh, where I would have had the opportunity to thank you in person for your considerate treatment.

Though I cannot exactly take your view of the matter, considering that the larger portion of your apparatus was furnished to me on Mr. Schmidt's suggestion for the purpose of facilitating further investigations in the field of my system of polyphase power-transmission, I nevertheless appreciate very much your fairness and would beg you to transmit to Mr. Westinghouse my thanks as well as my best wishes for success in the future.

It has been my principle, ever since I have devoted myself to scientific laboratory research, never to accept fees or compensations for professional services, and I could not take advantage of your offer were it not that most of your machinery was destroyed by fire. It would have been my duty to insure the apparatus, and in such an event the amount would been integrally turned over to you, but as it was not insured I am sharing your loss, since I have been deprived of the instruments which are necessary for the successful continuance of my labors in the province in which, thanks to Mr. Westinghouse's foresight, you are occupying the leading position to-day.

Although, if I were to prize my services, I would put on them a much higher value that youcould afford to pay, I wish to state here purposely and explicitly, that you should not feel in the slightest obliged to me for whatever I did for you, as I considered it fairly your due and to the interest of my friends and those who placed confidence in my opinion.

Believe me to be,

Yours very truly,

New York, Feb. 27th, 1898

#46 & 48 E. Houston Str.

Karl Till, Esp.,

136 W. 64 Str.,

N. Y. City.

My dear Sir: -

Will you please call at your earliest convenience at my office, above address. It is possible that I might be able to do something to your advantage.

Yours very truly,

New York, March 5th, 1898

#46 & 48 E. Houston Str.

Mr. Charles Till,

Westinghouse Electric Co.,

East End Ave., Pittsburgh Pa.

My dear Sir: -

I have been very glad to learn from your letter of March 3rd, just received, that my friends of the Westinghouse Company have found it possible to give you employment. When you came here I spoke to one or two friends about you, but there was still little prospect for a position.

I cannot conscientiously say that I could offer you anything better than you have at present and would advise you to stay there. Should you, however, be again in need of a position, you may call on me and I shall do my best to place you.

Yours very truly,

New York, March 27th, 1898.

#46 & 48 E. Houston Str.

Mr. George Westinghouse, Jr.,

120 Broadway,

New York City.

Dear Mr. Westinghouse: -

Prince Albert of Belgium, when visiting my laboratory the week before last, told me that he intended to see the plant at Niagara. I have no doubt that he would be interested in inspecting your Works as well as in meeting you personally, knowing you to be one of the great pillars of the electrical industry in this country. I am prompted by the interest I feel for you to ask whether or not you would extend to him such an invitation and, perhaps, offer him your hospitality on his visit to your many Works and Niagara Falls. It might not be only a matter of pleasure for you to meet him, but his personal acquaintances may also have an important bearing upon the development of some of your foreign affairs, for he is soon to be in a position of great power, being the heir presumptive to the Belgian throne. He is a very modest, unassuming young fellow who seems to friendship quickly.

Should you think it necessary to communicate with my in the matter, your letter will find me here, although it is not at all necessary. Prince Albert was in Philadelphia yesterday, and you will learn of his further movements through the Belgian consulate.

Yours sincerely,

GEO. WESTINGHOUSE.

PITTSBURGH, PA.

March 30th.1898.

Mr. Nikola Tesla,

New York.

Dear Mr. Tesla: -

I thank you for your favor of the 27th. Of March. I note that Prince Albert of Belgium is proposing to visit the plant at Niagara. I am at a loss to know just what to do inregard to inviting him to Pittsburgh. From some friends in Philadelphia I learned that he was making his own plans and declined any special attention. I am to be in New York Friday, and if you are down town between two and three o'clock I should be glad to see you at my office, when we can have a little talk in regard to this matter.

Yours truly,

Geo. Westinghouse

New York, May 10th, 1898.

#46 & 48, E. Houston St.

Mr. George Westinghouse, Jr.,

120 B'way, N. Y. City.

My dear Mr. Westinghouse: -

I am informed through the Secretary of the Belgian Legation that His Highness Prince Albert expects to be in Pittsburgh about the 28th and 29th of May.

I hope that this time will be convenient for you. Prince Albert, I under, is greatly pressed for time and will not be able to stay in Pittsburgh probably more than twenty-four hours. It may please you to learn that expressed himself through the Secretary in a most appreciative manner about yourself and your labors. While he did not exactly state that he would accept your hospitality, I believe that he will avail himself readily of the opportunity of knowing something more of man, who has contributed so important a share to electrical progress.

If you will kindly let me know, at your earliest convenience, what to answer, I shall be pleased to transmit your message.

Yours sincerely,

Westinghouse Electric & Manufacturing Company.

Pittsburg, Pa.

May 17th, 1898.

-N-

SUBJECT – TRANS-MISSISSIPPI INTERNATIONAL EXPOSITION.

Mr. Nikola Tesla,

#46 E. Houston street,

New York City.

My dear Sir: -

In the coming Trans-Mississippi International Exposition we have taken a large and prominent space and will give special prominence to a Tesla exhibit. We will have polyphase generators and motors, and desire to add to the interest of the exhibit by placing the early Tesla apparatus. A large exhibit of this was made the World's Fair which was then sent to you in New York. It is possible that this may have been lost in your fire, though perchance it may have escaped and is now available. We request that you will let us have for exhibit as much material as practicable. Let us know with regard to the matter at an early day as the Exposition opens very soon.

Very truly yours,

WESTINGHOUSE ELECTRIC & M'FG CO.

CFS

L. A. Oscorne

ASS'T TO SECOND VICE PRESIDENT

New York, May 18th, 1898

#46 & 48 E. Houston Str.

Westinghouse Electric Co.,

Pittsburgh, Pa.

Gentlemen: -

Your favor of May 17th, in the matter of the Trans-Mississippi International Exposition, has been received.

While I would prefer not to give undue prominence to my name, I would nevertheless do my upmost to comply with your wish, if I could do so efficiently. I have practically nothing suitable for exhibition beyond a large ring you forwarded to me, which is one my close companions in the laboratory and from which I would not like to part. I presume that people nowadays will be far more interested in your splended machinery than in this early apparatus.

Believe me to be,

Yours very truly,

New York, April 26th, 1896.

#46 & 48 E. Houston Str.

Mr George Westinghouse, Jr.,

Pittsburgh, Pa.

Dear Mr. Westinghouse: -

I take the liberty to introduce you to herewith Mr. Friedrich Ross, who in connected with some of my friends and associates in Germany. He is anxious to see your admirable plant in Pittsburgh, and I would be very much obliged to you for any courtesy extended to him on his visit.

With thanks I remain,

Yours sincerely,

New York, May 16th, 1898.

#46 & 48 E. Houston Str.

Mr. George Westinghouse, Jr.,

Pittsburgh, Pa.

Dear Mr. Westinghouse: -

Your letter referring to Prince Albert has just been received.

I have written to the Belgian Consul and have suggested that he should transmit the wishes of the Prince to you directly.

Believe me to be,

Yours very truly,

GEO. WESTINGHOUSE.
PITTSBURGH, PA.

#120 Broadway, New York, N. Y.,

May 19th, 1898.

Nikola Tesla, Esq.,

#46 East Houston St., City.

Dear Mr. Tesla: -

I have just arrived in New York and find your letter of the 16th inst. I received a letter from the Belgian Vice Consul Mr. Mali saying that he has sent the letter I wrote you to Counsellor Joostens at the Auditorium Hotel, Chicago.

I had a conference with the Belgian Minister and have in consequence written formally to Counsellor Joosten's through him inviting the Prince and his party to be the guests of myself and Mrs. Westinghouse while in Pittsburg, and have laid out an inspection tour which I trust will be satisfactory to them.

Thanking you for your letters I am,

Very truly yours,

Geo. Westinghouse

P.S. I am leaving tonight for Lenox with the expectation of being back here Saturday morning and leaving again at one o'clock for Washington.

P.P.S. I have just received a telegram from Counsellor Joostens accepting the invition of Mrs. Westinghouse and myself.

Westinghouse Electric & Manufacturing Company.

Pittsburg, Pa.

-A- Oct. 12th.1898

Mr Nicola Tesla,

New York City, N. Y.

Dear Sir: -

Your telegram of October 12th., addressed to Mr. Means has been referred to me.

The man you refer to is probably Mr Haardt, who came to us last December. I have just spoken to him about the matter and he in doubt as to whether he wishes to take the position.

Would request that you kindly advise me what is the nature of the work required and if Mr Haardt wishes to accept the position, we shall be glad to let you have him. If not, I will see if we can recommend another candidate.

Yours very truly,

OSL-Jr/G

O. S. Lyford jr.

Chief Engineer.

P.S.

Have just telegraphed you as follows, "Means not with this Company. Have written."

OSL-Jr.

New York, Oct. 12th, 1898

#46 & 48 E. Houson Str.

Westinghose Electric Mfg. Co.,

Pittsburgh, Pa.

Gentlemen: -

I wish to thank you for your courteous reply to my dispatch to Mr. Means to-day. It was with regret that I learned of his leaving your employ, and I hope you will excuse me for troubling you unknowingly with the matter.

It is due to you to explain that I inquired about Mr. Haardt, who wrote me some time ago, applying for a position with me. Mr. Haardt came to this country for a short stay, and he was recommended to me by my Professor Bertel of the Polytechnic School in Gratz. I am very desirous to oblige my professor and inqure about Mr. Haardt with a view of giving him the employment he sought for. Of course, all was subject to Mr. Means' approval.

Yours very truly,

Pittsburg, Pa. East End Ave. – Nov – 16 – 98.

Mr. Nikola Tesla

New York

46 – 48 – E. Houston str.

Dear Sir. –

Thanking you for your kind letter of the 8th. I beg to say, that private circumstances made my departure from here necessary and with your kind permission I will inform you of my where-abouts in the near future.

Respectfully Yours,

Charles V. Till

NEW YORK., Nov. 29th, 1898.

#46 & 48, E. Houston Str.

Mr. George Westinghouse, Jr.,

120 Broadway,

N. Y. City.

Dear Mr. Westinghouse: -

Owing to some unforeseen outlay I am compelled to ask you through your kind intervention, which I hope you grant, of your Company a loan of $6,000. I shall return the money within three months.

As I do not owe any money to any one, my property, though small, would be ample security for this amount, but in order to obviate and possible loss to your Company, I wish pledge herewith my rights to the English royalties.

Assuring you that your personal kindness as well as the considerate treatment by your Company will not be forgotten, I remain,

Yours sincerely,

GEO. WESTINGHOUSE.
PITTSBURGH, PA.

#120 Broadway, New York, N. Y.

November 29th, 1898

N. Tesla, Esq.,

#46 & 48 E. Houston St., City.

Dear Doctor Tesla: -

I have just received your letter and take pleasure in saying that the Company will loan you the $6,000 according to the terms of your letter. You will kindly call upon Mr.Ph.Ferd.Kobbe Treasurer of the Company between two and three o'clock tomorrow and he will arrange the details with you.

Truly yours,

Geo. Westinghouse

New York, Nov. 30th, 1898.

#46 & 48 E. Houston Str.

Mr. Geo. Westinghouse, Jr.,

120 Broadway,

New York City.

Dear Westinghouse: -

Acknowledging your kind letter of even date, I wish to again express my thanks for your readiness to aid me in the matter, which I have appreciated as much as the service itself.

Yours very truly,

GEO. WESTINGHOUSE.

PITTSBURGH, PA.

New York,
December 1st. 1898.

Dr. Nikola Tesla,

46 & 48 E. Houston street,

New York.

Dear Doctor Tesla: -

After you left yesterday I determined to write you without loss of time with reference to your device for commutating alternating into direct currents. Just at the present time there is great use for something of that sort, I would like to knoe if you have advanced far enough with your patents and experiments to be now in a position to let the Westinghouse Electric & Mfg.Co. undertake the manufacture of such apparatus upon reasonable terms. You will appreciate of course the particular advantage it would be to you personally to have such an important device put upon the market by the Westinghouse Company. Can you tell me how large an apparatus you have made? and how many h.p. of energy suchapparatus will transform? And I should like to know the voltages you have operated it with so far.

Yours truly,

Geo. Westinghouse

New York, Dec. 5th, 1898.

#46 & 48 E. Houston Str.

Mr. Geo. Westinghouse, Jr.,

120 Broadway,

New York City.

Dear Mr. Westinghouse: -

I have not been well enough for last two or three days to attend my correspondence, otherwise your kind letter of Dec. 1rst would have been at once answered.

I wish to tell you, in answer to your inquiry, that I have bestowed much more time upon this subject that you might have thought. I have not one, but a number of devices which I propose to put on your circuits, and for all of them there is a great demand. Just as soon as I shall have completed an arrangement of vital interest to myself which, I expect, will be in the course of two or three weeks, I shall be in the position to approach you with the matter. You may believe me that I shall use my best efforts to advance your interests while furthering my own.

Yours sincerely,

GEO. WESTINGHOUSE.

PITTSBURGH, PA.

New York,
December 8th, 1898.

Mr. Nikola Tesla,

New York City.

Dear Doctor Tesla: -

I have just returned from Pittsburgh and find your letter of the 5th of December. A matter of great importance to me just now is the question of a simple and economical device for converting alternating to continuous currents, and I hope that you will let me know abuot this with as little delay as possible. In the meantime I trust that you will speedily complete the arrangements which you say are of vital interest to you.

Yours truly,

Geo. Westinghouse.

New York, Dec. 12th, 1898.

#46 & 48 E. Houston Str.

Mr. Geo. Westinghouse, Jr.,

Pittsburgh, Pa.

Dear Mr. Westinghouse: -

Although your kind letter of Dec. 8th does not require an immediate answer, I wish to assure you that I am making no effort to bring this device on the market as soon as possible. I am confident that the arrangements to which I have reference in my last letter to you will be completed soon, as I have the assurance of the effect of men who are beyond any doubt.

Meanwhile it will be of my most sincere hopes that my labors may result in a personal advantage to you.

Yours sincerely,

Westinghouse Electric & Manufacturing Company.

120 BROADWAY,

NEW YORK, N. Y. February 21st, 1899.

Nicola Tesla, Esq.,

#46 East Houston St., City.

Dear Sir: -

We beg to remind you that your note for

	$6.000.00
+ Interest.	90.00
Total	$6090.00

Is payable at this office on February 28th, 1899.

Kindly have funds here in time to meet the same and thereby oblige,

Yours truly,

G. W. Hebord

Acting Vice President.

New York, Feb. 24th, 1899

#46 & 48 E. Houston Str.

Westinghouse Elec. & Mfg. Co.,

120 Broadway,

New York City.

Gentlemen: -

Your very categorical reminder of Feb. 21rst has been duly received, and with the exception of its being premature, unnecessary and rather terse in expression, and implying the erroneous assumption that I was forgetful of assumed duties, it was appreciated and approved as an effort to discourage the objectionable habit of borrowing money.

Long ago I would have taken the pleasure of calling on you with reference to the agreeable cause of our last meeting, had I not been since that time engaged in psychological research, to which the recent utterances of my illustrious friend, Sir William Crookes, have prompted me. I am variance with him and other philosophers as to the origin of mental states and transmission of mind efforts. According to my contention, there is no mental state which would not be the direct result of physical impressions, not can there be any influence of mental efforts at a distance. This vey experience with you has afforded me a striking illustration of the truth of my contentions. The other day I dreamt that I received from you a check for fifty thousand dollars, inclosed in a letter, the wording of which I cannot now exactly remember. I think, though, you stated that this sum was but a small compensation for services I had rendered to you for several years. I can distinctly recall that, among other things, you referred to me going to all my wealthy friends and enlisting their interest on your behalf at a time when you were in adversity, and to my great help in connection with your enterprises at Niagara, Massena and many other places, and if I do not err, judging from your statements, you seemed actually overwhelmed, not to say distressed, as the amount of indebtedness to me.

Now on awaking, I began to investigate the origin of this singular dream, which gave me much pleasure for a moment, and after carefully examining all of the old shelves of my memory, I satisfied myself thoroughly that, in accordance with my views, every particular of this dream was suggested by events which had actually occurred. Naturally I was greatly interested to see where there was any truth to the doctrine of thought transmission, which my illustrious friend and some of his followers are now propounding. Of course, while of the opposite opinion, I could not ignore the views of such high authorities, and my interest naturally rose to the point of excitement as the 28th of February drew near. I was about at the height of my expectations, when your appreciated favor of the 21rst inst., before referred to, reached me. Its contents left no room for doubt in my mind, that there was not any thought transmission in this instance, and I was further strengthened in my view that the interaction and equivalency of efforts, which Spencer so eloquently propounds in his "First Principles" and which literally apply to the material world, do not hold good for mental states.

The recognition of these important truths and unification of the several corrollaries and deductions derived from them, will forcibly lead to the foundation of a new system of philosophy, extremely materialistic in its general aspects and characteristics, but highly useful for all practical purposes, when thoroughly compredended and rigorously applied in all dealings and relations with our fellowmen. The current belief in the integral restoration of efforts not demonstrable by material evidences, which has heretofore often formed the basis of verbal understandings and agreements greatly to the advantage of those whose epidermis is developed to such an unusual degree of thickness, which is peculiar to a certain class of low animals commonly known as crocodiles – will gradually disappear and will be finally restricted to those individuals who have a natural predisposition for the non-fulfillment of their objects and desires in the various pursuits of life. It will become an absolute necessity for the furtherance of worldly interests and maintenance of friendly and harmonious relations to establish in advance exact, material and tangible equivalents for all of our efforts and performances, and it will be soon recognized that a close observance of these principles will be condutive a great success, while ignoring them will, sooner or later, bring about a disasterous failure.

Apologizing that under the spell of these thoughts I have forgotten myself to dwell at length on this subject, possibly of no interest to you, and calling your attention to the inclosed check for $6090.00, the receipt of which you will oblige me by acknowledging, I remain, with thanks,

Yours truly,

Inclosure.

Westinghouse Electric & Manufacturing Company,

120 BROADWAY, NEW YORK, N. Y. February 27th, 1899.

Nikola Tesla, Esq.,

#46 East Houston St., City.

Dear Sir: -

We have to acknowledge receipt of yours of the 24th inst. enclosing your check for $6090.00 to retire your note due on February 28th.

We therefore return you herewith your note of Nov. 30th, 1898: Your letter of November 30th addressed to the Tesla Company, and Your receipt of the same date, all of which we trust will reach you safely.

Yours truly,

G. W. Hebord

Acting Vice President

Enc.

GEO. WESTINGHOUSE.

PITTSBURGH, PA.

New York,
April 20th. 1899.

Dear Mr. Tesla:

I was sorry not to see you when you were in, but my engagement was such that I could not come from the Club to see you. This letter will be handed to you by Mr. Mershon, who knows all about the electric light and power matters in and about Pike's Peak, having been connected with the Colorado Electric Power Company. I have asked Mr. Mershon to giveyou all the information in his power, and if there is anything further that can be done, in any way or letters on otherwise, I shall be glad to render any assistance possible.

Very truly yours,

Geo. Westinghouse

Nikola Tesla, Esq:

46 East Houston st.,

New York.

New York, Jan. 22nd, 1900.

46 & 48 East Hoston Str.

Mr. George Westinghouse, Jr.,

Pittsburgh, Pa.

Dear Westinghouse:

Please receive the following communication as a personal one. I have just returned from Colorado, where I have been carrying on some experiments since a few months past. The success has been even greater than I anticipated, and among other things I have absolutely demonstrated the practicability of the establishment of telegraphic communication to any point on the globe by the help of the machinery I have perfected. In carrying out the plan I shall want a direct connected engine and dynamo of at least three hundred horse-power, but preferably more, on either side of the Atlantic, and as this would involve a considerable expensive which, in view of the apparent impossibility of the problem, and also because of a panicky feeling all around, I fear I would have difficulty in securing, I wish to ask you whether you would not meet me on some fair terms in furnishing me the machinery, retaining the ownership of the same and interesting yourself to a certain extent in a way which I cannot yet clearly specify, but which might be found after a mutual exchange of ideas on the subject. I am naturally prompted by self-interest in making this proposal, but you may believe me that, behind it, there is also a sincere desire to advance our own. The demonstrations which I have made in Colorado are of such a nature that they preclude the possibility of a failure, and the performances of the machines which I have developed are of such character as to almost surpass belief. You will know, of course, that I contemplate the establishment of such a communication merely as a first step to further and more important work, namely that of transmitting power, but as the latter will be an undertaking on a much larger and more expensive scale, I am compelled to first demonstrate one feature to get the confidence of capital.

I am obliged to accompany this proposal by a request which you will greatly oblige me by complying with without much delay. I have been so enthused over the results achieved and have worked with such a passion, that I have neglected to make such provisions for money as would have been dictated by prudence, and on my return I find that I may have to make some payments before certain funds, which are due to me, may reach me. Being thus compelled to borrow money, I turn to

you to ask whether your Company will not advance me, say $6000, on the guarantee of my royalty rights for England, or, if preferable, whether they would not buy outright my claims on the royalty for a sum of $10,000. I would prefer to borrow money and pay the interest, as I am not quite sure that I ought to sell my share, which is four ninths of the total about due to my Company, not knowing exactly whether, in so doing, I might hurt the interests of my associates, Mr. Brown and Mrs. Peck. Needing, however, the money and thinking that my right in your hands, would, if anything, enhance the value of their share, since it would give your Company an additional cause to push the business, I have ventured to make this suggestion. At any rate, I hope that you will be able to mail me a check within a day or two, on whatever terms you may prefer. I shall certainly be greatly obliged for the service.

I make no secrecy of needing the money, but as regards the plan of transmitting messages, I would not want yet to be known until some of my patents, which are allowed, shall have been issued.

Yours sincerely,

MEMORANDUM OF AGREEMENT: made and entered into this tenth day of April, One Thousand Nine Hundred, between Nikola Tesla, of the City, County, and State of New York, and the Westinghouse Electric and Manufacturing Company, a corporation organized and existing under the laws of the State of Pennsylvania, WITNESSETH:

WHEREAS, The Tesla Electric company entered into an agreement with the Westinghouse Electric Company, Limited, bearing date the 22nd day of May 1896, by which is sold, assigned, transferred and set over to the said Westinghouse Electric Company, Limited, all its rights under Letters Patent of Great Britain and certain British Colonies upon inventions of Nikola Tesla, relating to the electric transmission and application of energy by alternating currents, as enumerated in "Schedule A", attached to said agreement, and also all its rights to the renewal, reissue or extensions of said letters Patent, or any of them, and all the rights for Great Britain and the British Colonies upon improvements theretofore made or that might thereafter be made by Nikola Tesla, in the system of transmission or distribution of power by alternating currents covered by said patents, or any of them, or apparatus, machinery, appliances or devices connected therewith: and,

WHEREAS, the said Westinghouse Electric Company, Limited, in consideration of the rights conferred as above, agreed, among other things, to pay to the said Tesla Electric Company, one-quarter of all royalties which it might receive from licenses under said patents or any of them of by way of damages for the infringement of said patents, and also royalties equal to twenty-five percent of the average rate at which other manufacturers pay royalty to said Tesla Electric Company, for the use of said patents for all apparatus which the said Westinghouse Electric Company, Limited, might itself manufacture and sell under the protection of said patents after the date of the said agreement; and,

WHEREAS, the said Nikola Tesla is now desirous of selling and assigning his said interest to the royalties to be paid under said agreement of May 22, 1896, to the Westinghouse Electric and Manufacturing Company:

NOW, in consideration of the return to said Nikola Tesla, of his note to the Westinghouse Electric and Manufacturing Company, for Six Thousand Dollars ($6,000.) with interest, dated January 30, 1900, and the further sum of Four Thousand Dollars ($4,000) paid upon the execution and delivery of this agreement, to said Nikola Tesla, by the Westinghouse Electric and Manufacturing Company, all of the said interest which he, his heirs or assigns may have in the royalties which may be due to the Tesla Electric Company, under the terms of the agreement of May 22, 1896.

IN TESTIMONY WHEREOF: we have caused these present to be executed the day and year first above written.

Nikola Tesla

WITNESSES:
Charles A. Terry –
Secretary.

STATE OF NEW YORK :
:ss-
COUNTY OF NEW YORK:

On this tenth day of April, in the year One Thousand Nine Hundred, before me personally came Nikola Tesla, to me known, and known to me to be one of the parties described in and who executed the foregoing instrument, and he acknowledged to me that he executed the same.

H. M. Capel
Notary Public, N. Y. County, N. Y.

STATE OF NEW YORK :
:ss-
COUNTY OF NEW YORK:

On this tenth day of April, in the year One Thousand Nine Hundred, before me personally came Charles A. Terry, to me known, who being duly sworn, did depose and say that he resided in New York City; that he is the Secretary of the Westinghouse Electric and Manufacturing Company, the corporatie described in and which executed the above instrument; that he knew the seal of said corporation; that the seal affixed to said instrument was such corporate seal; that it was so affixed by order of the Board of Directors of said corporation, and that he signed his name thereto by like order.

H. M. Capel,
Notary Public
New York County, New York

New York, April 10, 1900.

Westinghouse Electric and Manufacturing Company,
120 Broadway, New York City, New York.

Gentlemen: --

Referring to the agreement entered into this day regarding my share of royalties to be paid by the Westinghouse Electric Company, Limited, to the Tesla Electric Company: I guarantee that I do have not made any agreement or engagement with any one else which will in any way interfere with the payment of the four-ninths of the royalties to you in accordance with this agreement, and I will, if necessary, obtain any further consents from the other parties interested in the Tesla Electric Company.

Yours truly,

GEO. WESTINGHOUSE.

PITTSBURGH, PA.

120 Broadway, New York,

September 5th, 1900.

Dear Doctor Tesla:

On my arrival in New York this morning I find your letter of August 30th, for which I thank you most sincerely. I think we are both to be congratulated on the outcome of the suit: you, because the Courts have awarded you to you the credit for a great invention; and we, because we are likely to have our rights respected so that we may reap some of the advantages due to the large expenditures we have made in the commercial development of your inventions.

You know I appreciate your sympathetic interest in my affairs.

Believe me,

Most sincerely yours,

Geo. Westinghouse

New York, March 13th, 1901.

46 & 48 East Houston Str.

Mr. Geo. Westinghouse, Jr.,

120 Broadway, New York City.

Dear Mr. Westinghouse: -

In accordance with our conversation to-day I wish to say, that I shall hope to have the pleasure of seeing you in Pittsburgh next Tuesday. It will be best, under the circumstances, to post-pone a further step until that time.

With thanks for your courtesy, I remain,

Yours very truly,

GEO. WESTINGHOUSE.

PITTSBURGH, PA.

New York, March 18th, 1901.

Nikola Tesla, Esq,

46 & 48 East Houston St.,

New York.

Dear Mr. Tesla:

I duly received your letter saying that you would be in Pittsburgh Tuesday in accordance with our conversation. I find that important business matters will keep me in New York until Tuesday night, and I therefore trust it will be quite convenient for you to be in Pittsburg Wednesday.

I now expect to go by the train leaving Jersey City at 8:44 p.m. tomorrow, and if that train will be a convenient one for you, I should be glad to have you go with me on my car, which, upon inquiry, you will easily find in that station.

If convenient for you to do so, kindly come to Jersey City at about 7:30, so that you may dine with us on the car.

Truly yours,

Geo. Westinghouse

COPY.

Waldorf-Astoria

New York. Jan 11. 1906.

George Westinghouse, Esq.,

120 B'way., New York.

My dear Mr. Westinghouse:

Has anything happened to mar the cordiality of our relations? I would be very sorry not only because of my admiration for you but for other serious reasons.

The transmission of power without wires will very soon create an industrial revolution and such as the world has never seen before. Who is to be helpful in this great development, and who will derive from it greater benefits than yourself?

Please be mindful in your contact with others-not of my personal interest, for that is of little consequence-but of this far advanced work now in the delicate stage of a sprout. It is easy to destroy and difficult to succeed.

I ask no favor but I would like to feel that you entertain for me the same high regard which you have always shown.

Yours very truly,

165 Broadway, New York.
November 21, 1908.

Mr. George Westinghouse,

165 Broadway,

New York City.

Dear Mr. Westinghouse: --

I have read in the papers of this morning with great pleasure of the success of your plan of re-organization.

The strength of a man shows itself in adversity. You have overcome obstacles which seemed insuperable and once more shown that you are one of those who cannot be downed. Please accept my heartiest congratulations.

Yours faithfully,

GEO. WESTINGHOUSE.

PITTSBURGH PA.

November 24, 1908.

Dear Mr. Tesla:

Very many thanks for your letter of November 21st. There is very much yet to do before all of my things get settled down.

I thank you sincerely for the hearty congratulations.

Truly yours,

Geo. Westinghouse

Nikola Tesla, Esq.,

165 Broadway,

New York City.

165 Broadway, New York.
June 4th, 1910.

Dear Mr. Westinghouse: -

My friend Brishane writes many rotten editorials but he is a genius and when he strikes the proper subject, he does it well. The enclosed is one of those.

Yours sincerely,

George Westinghouse, Esq.,

165 Broadway, New York.

Enclosure.

165 Broadway, New York.

August 10th, 1910.

Dear Mr. Westinghouse:

I suppose you cannot help feeling disappointed at the ingratitude of some who are now heading the great enterprise which your genius has created, but such statements as the enclosed may afford you some consolation.

With expressions of high esteem, believe me,

Yours very sincerely,

George Westinghouse, Esq.,

165 Broadway, New York.

enclosure.

GEO. WESTINGHOUSE

PITTSBURGH, PA.

August 15, 1910.

Dear Mr. Tesla:

Many thanks for your letter of August 10th with its enclosure from the Evening Mail, which I had already seen. I am quite sure you will live to see a great change in the sentiment of the public in regard what may prove to be only a temporary reverse.

With thanks to you for your letter, I am,

Very truly yours,

Geo. Westinghouse

Mr. N. Tesla,

165 Broadway,

New York.

165 Broadway, New York.

August 19, 1910.

Dear Mr. Westinghouse:

Acknowledging receipt of your kind letter of the 15th. I sincerely hope that you will very shortly be again in the position you have heretofore occupied in connection with the great industries which own their existence to your untiring efforts. I feel sure that a large majority of the public is entirely in sympathy with you.

Believe me,

Yours faithfully,

George Westinghouse, Esq.,

Pittsburgh, Pa.

DUPONT CIRCLE,

WASHINGTON, D.C.

Windsor Hotel

New York Dec 28th

Dear Mr. Tesla

Your very considerate letter touched Mrs. Westinghouse and myself very deeply. I had told my mother of you and was hoping to have you visit us so she could see you and now can never be. We thank you sincerely, for your sympathetic words and trust you may have a healthy New Year and much happiness.

Sincerely yours,

Geo Westinghouse

A 3/11

New York March 12 1893

Dear Mr. Adams,

Although I have had exchange of thoughts with you in regard to your fav. of Feb. 23d. I consider it necessary to express myself quite clearly and by letter in regard to the subject.

The patent of Thomson Nr. 363.186, to which reference is made, has absolutely nothing to do with my discovery of the rotating magnetic field and the radically novel features of my system of transmission of power disclosed in my foundation patents of 1888. All the elements shown in the Thomson patent were well known and had been used long before by a number of

experimenters. I myself exhibited such devices early in 1887, but I was not encouraged to work in that direction as I found that the motor was very inefficient and that the commutator and brushes caused trouble. I showed in my patents that alternating motors could be run without the employment of a commutator and I produced an efficient and practical motor, which I was able to run either on multiple or single alternating circuits. In fact, one of the many reasons why I advocated the adoption of two phase currents rather than three phase shown in my patents was, that a two phase motor was better suitable for single or ordinary alternating circuits and that it could be operated on these circuits with fair efficiency, though smaller than that obtained by the use of multiple supply circuits. Some engineers do not realize this even to-day.

As to the Bradley patents,

New York _____ 189_

to which reference is likewise made, I would think it fair to all concerned that a thorough examination be made of their history and bearing. Such examination, which has been made by myself without the slightest prejudice, will convince you that in the earliest patents there is not the least hint of a method of transmission of power which would be useful, or of devices which would not have been described before. As regards the later patents they are plainly covered by my fundamental claims. Engineers are beginning now to

realize that the earning capacity of an alternating plant with currents of more than one phase is much greater and that we are forcibly driven to introduce in our alternating systems of distribution multiple circuits. Some think that a perfect alternating motor, to be run on single circuit, would satisfy all needs. In reality such a motor would have a very limited value in a year or two, when, in consequence of competition the necessity will arise to use more than one circuit. The direct systems had to go through such a process merely for the sake of saving some copper, and their engineers had to make expensive changes and considerably complicate the systems at that.

Yours sincerely

N. Tesla.

P.S. Thanks for clippings received.

New York Jan. 9 1893

Dear Br. Adams,

Last night I going with Br. White over the clean specification of Prof. Unwin I noted that Prof. Unwin gives the speed of the turbine to be about 150 rev. I thought it barely possible that all the details have not been explained to him and that consequently he might not be aware of certain disadvantages resulting from the low speed. For instance from the sketch you showed me I understood, that the distance between the wall and Dynamo was only 8-10 feet on the assumption, that the Dynamo had a diameter of something like 19 ft. Now I believe that in the design of Br. Schmidt

the dynamo is of very nearly the above diameter on the assumption that the speed of the turbine is 250 rev. If you wish reduce the speed it would necessitate, if proper rules of construction are observed, that the diameter of the dynamo be made considerably larger, which would leave still a smaller space between the wall and the machine, and this of itself, with such magnificent machinery which will be viewed by thousands, would be decidedly bad. Of course, I need not say that such a low speed dynamo would cost much more. I am of the opinion that you should consider this, so much the more, as Prof. Harris does not lay particular stress upon the low speed but merely would prefer it if it were practicable. Even with 250 rev. the dynamo is, to be sure, large enough.

Kindly consider this communication and others which I may make entirely personal as I would not wish be risk of offending Prof. Harris, whom I highly esteem:

Yours sincerely

N Tesla.

TESLA MEMORIAL SOCIETY, INC.
21 Maddaket, Southwyck Village
Scotch Plains, New Jersey 07076

Letter from Nikola Tesla to Edward Dean Adams dated January 9, 1893
Draft of text handwritten on Gerlach Family Hotel stationary (italics to show indistinct writing)

(First handwritten page)

New York Jan. 9 **1893** (bold preprinted on Hotel stationary)

Dear Mr. Adams,

Last night in going with Mr. White over the *clear* specification of Prof. *Xxxx*'s I noted that Prof. *Xxxx*'s wishes the speed of the turbine to be about 150 rev. I thought it barely possible that all the details have not been explained to him and that consequently he might not be aware of over-*load* disadvantages resulting from the load speed. For instance from the sketch you showed me I understood, that the distance between the wall and the dynamo was only 8-10 feet on the assumption, that the dynamo had a diameter of something like 19 feet. Now I believe that in the design of Mr. *Schmid*

(Second handwritten page)

the dynamo is of very nearly the above diameter on the assumption that the speed of the turbine is 250 rev. If you would reduce the speed it would necessitate, if proper rules of construction are observed, that the diameter of the dynamo be made considerably larger, which would leave still a smaller space between the wall and the machine, and this I think, with such *significant machinery* which will be viewed by *Morivands*, would be decidedly bad. Of course, I need not say that such a low speed dynamo would cost much more. I am of the opinion that you should consider this, so much the more, as Prof. *Xxxx*'s does not lay particular stress upon the low speed but surely would prefer it if it were practicable. Even with 250 rev. the dynamo is, to be sure, large enough.

Kindly consider this communication and others which I may make entirely personal as I would not run the risk of offending Prof. *Xxxxx*, whom I highly esteem:

Yours sincerely
N Tesla.

WHT/tmsxa

TESLA MEMORIAL SOCIETY, INC.
21 Maddaket, Southwyck Village
Scotch Plains, New Jersey 07076

Letter from Nikola Tesla to Edward Dean Adams dated February 2, 1983
Draft of text handwritten on plain stationary (italics to show indistinct writing or clarification)

(First handwritten page)

Feb. 2, 1893

Dear Mr. Adams,

Your fav. *(favor)* has just reached me. The danger when working unattended is not as great as you may suppose. I have been constantly at work with currents up to a quarter million volts for two or three years past and have met with only one accident. Of all forms of energy harnessed in the service of man, that of electricity is certainly the least dangerous were it only on account of the fact that but a single person can be injured at a time.

I have not as yet heard from Germany but I have not the slightest doubt that all Companies except Helios, who have acquired the rights from my Company will have to stop the manufacture of phase motors. Proceedings against the infringers

(Second handwritten page)

have been taken in the most energetic way by the Hélios Co. It is for this reason that our enemies are driven to the single phase system and rapid changes of opinion.

In regard to your query about synchronous motors I would say that the motors will run in exact synchronism with the generator in spite of any number of transformations. We can also make according to my patents changes in the speed as we like. For instance the motor may be made to run at any fraction (within certain limits) or multiples of the speed of the generator. This feature is valuable in the general distribution. I would also say, that besides synchronous forms of motor we have also such as required for the operation of devices requiring great effort but not constant speed, as for instance, cranes e.t.c.

That the phase system is not yet in extensive operation is due merely to circumstances of which you are aware to some extent. A number of motor plants have been put in mines where they have given the utmost satisfaction. There is no danger that the phase system will be superceded *(variant of superseded)* by the single current system. The advantages of the former are to *(sic)* great. Next time I have the pleasure to meet you I will show you the reasons.

Sincerely yours
N Tesla.

P. S. Please kindly excuse this hasty communication. *(Written vertically in the left-hand margin of second page)*

WHT/tmsxb

TESLA MEMORIAL SOCIETY, INC.
21 Maddaket, Southwyck Village
Scotch Plains, New Jersey 07076

Letter from Nikola Tesla to Edward Dean Adams dated February 6, 1893
Draft of text handwritten on plain stationary (italics to show indistinct writing or clarification)

(First handwritten page)

Feb. 6, 1893

Dear Mr. Adams,

I thank you for your attention shown by your letter of the 4th inst. which has reached me in due course together with enclosures which I herewith return.

In regard to the article you had the kindness to call to my notice I would say that the writer has expressed a number of times quite opposite views. I have been sorry to find his contributions as a rule so weak, that it was quite impossible for me to comply with scientific courtesy by answering them. The plan proposed by him is many years old and has been repeatedly tried especially at the debut of the alternating system, but was found impracticable. I would want to have a longer

(Second handwritten page)

talk with you to explain some details and you would at once see the absurdity of the plan. Were it at all practicable I could prove at any time that my system would offer a saving of 40% - 50% over his.

I have to tell you the term "multiphase motors" comprises 3 distinct forms of my motors: 1) Non synchronous (used at *Lauffen*) 2) Synchronous but entirely alternating 3) Synchronous with field – directly *excited*. All criticisms apply only to the first two forms. In both forms the highest efficiency can be reached, and their only defect is that the current is somewhat larger than it ought to be in a perfect machine. This defect, however, does not amount to anything in ordinary practice as it may be made to disappear entirely. To illustrate, we only need to raise the e.m.f. 25% and we save on copper even against the direct current system.

(Third handwritten page)

Objections as to the current have therefore no weight, as it is much easier to run a machine which has no commutator or brushes with an e.m.f. 25% higher than a direct current machine with an adequately smaller e.m.f. Not to speak of the advantages which the ideal simplicity of these machines affords in the long run.

Under frequent conditions in practice it would be entirely impossible for any system to compete this ideally simple one; but I must say that again under different conditions a better solution is possible. This is the third form of my motor. This form

has never been criticized by the adversaries of my system and for a good reason, because it is the most efficient form of electric machine that has been produced to this day. I have shown that on such machines under favorable conditions an efficiency of 97% can be obtained. In output per weight it can be equaled

(Fourth handwritten page)

by no machine whatever, direct or alternating. It also possesses the ideal feature of running in absolute synchronism with the generator, while it has a good starting *figure*. This is the type of machine you have seen and which the W. Co *(assume Westinghouse Company)* propose to use for large units. You need not think that this form of machine has not been thoroughly tried. This machine merely is equivalent to two or three synchronizing machines coupled. A saving of expense and numerous practical advantages of *vital importance* is the result. For large units, especially, it would be utterly impossible for any system to compete with this. The advantages of *this* system are so great that even had we today a perfect alternating current motor requiring two wires, the system would have to be introduced just as soon as it comes to *earning* dividends *on* the capital. The three wire system offered to the direct current distribution *comprising* very small advantages, yet the three wire system was adopted. But what is recognized merely an advantage in direct current distribution will become dire necessity in the alternating system.

(The following written vertically in the left-hand margin of the fourth page)

Sincerely yours
N Tesla

Excuse haste

WHT/tmsxc

TESLA MEMORIAL SOCIETY, INC.
21 Maddaket, Southwyck Village
Scotch Plains, New Jersey 07076

Letter from Nikola Tesla to Edward Dean Adams dated March 12, 1893
Draft of text handwritten on Gerlach Family Hotel stationary (italics to show indistinct writing or clarification and bold to show text underlining)

(First handwritten page)

New York, March 12 **1893** (bold preprinted on Hotel stationary)

Dear Mr. Adams,

Although I have had exchange of thoughts with you in regard to your fav. (favor) of Feb. 23rd I consider it necessary to express myself quite clearly and by letter in regard to that subject.

The patent of Thomson Nr. 363.186, to which reference is made, has absolutely nothing to do with my discovery of the rotating magnetic field and the radically novel features of my system of transmission of power disclosed in my foundation patents of 1888. All the elements shown in the Thomson patent were well known and had been used long before by a number of

(Second handwritten page)

experimenters. I myself exhibited devices early in 1887, but I was not encouraged to work in that direction as I found that the motor was very inefficient and that the commutator and brushes caused trouble. I showed in my patents that alternating motors could be run without the employment of a commutator and I produced an efficient and practical motor, which I was able to run either on multiple or single alternating circuits. In fact, one of the many reasons why I advocated the adoption of two phase currents rather than three phase shown in my patents was, that a two phase motor was better *suitable* for single or ordinary *existing* circuits and that it could be operated on these circuits with fair efficiency, though smaller than that obtained by the use of multiple supply circuits. Some engineers do not realize this even today.

As to the *Bradley* patents,

(Third handwritten page – on Hotel letterhead stationary)

to which reference is likewise made, I would think it fair to all concerned that a thorough examination be made of their history and bearing. Such examination, which has been made by myself without the slightest prejudice, will convince you that in the earliest patent there is not the least *hint* of a method of transmission of power which would be novel, or of devices which would not have been described before. As regards the later patents they are plainly covered by my fundamental claims.

Engineers are beginning now to

(Fourth handwritten page)

notice that the *earning* capacity of an alternating plant with currents of **more than one** phase is much greater and that we are forcibly driven to introduce in our alternating systems of distribution multiple circuits. Some think that a perfect alternating motor, to be *on one* single circuit, could satisfy all needs. In reality such a motor would have a very limited value in a year or two, when, in consequence of competition the necessity will rise to use more than one circuit. The direct systems had to go through such a process merely for the sake of saving some copper, and their engineers had to make extensive changes and considerably complicate the systems at that.

Yours sincerely
N. Tesla.

P. S.
Thanks for the clippings received.

WHT/tmsxd

TESLA MEMORIAL SOCIETY, INC.
21 Maddaket, Southwyck Village
Scotch Plains, New Jersey 07076

Note from Nikola Tesla to Edward Dean Adams dated March 22, 1893
Draft of text handwritten on 5 x 8 inch lined notepaper (italics to show indistinct writing or clarification and bold to show text underlining)

(First handwritten sheet)

New York March 22, 1893.

Dear Mr. Adams,

Your fav. *(favor/letter)* received. I forward copy of "Electrician" of Aug. 5.
The writers of these articles are absolutely unacquainted (that is they **were**) with some facts. For instance they do not know that by merely winding the motor in a certain way absolute constancy of the field is obtained with two phases, so that it is the same as far as this is concerned

(Second handwritten sheet)

whether there are *two* or a million phases. But the gravest error the Authors make is that they express the belief that the constancy of field is important for the efficiency of the motor. In my earlier work I thought so and constructed motors with many phases. You will find in going over my writings and patents that I have before advanced all these views, and what these writers state in this journal is merely a repetition of what I have shown or stated. But I convinced myself that it is not im-

(Third handwritten sheet)

portant at all to have the field constant. The chief importance in an alternate current motor rests upon the *intimate* magnetic connection between the field and armature coils, as I have pointed out long ago. But even the closure of the magnetic circuit must be influenced by practical considerations. For instance some of my first motors I made with holes in the armature and field in order to close the magnetic circuit more completely. This *causes* some disadvantages when the machine is worked

(Fourth handwritten sheet)

directly, also when it is operated from a transformer (more or less). We found that for each motor, according to what it is built for, certain rules of construction had to be followed. On this entire books can be written. Even presently there are perhaps one half a dozen Engineers who know fairly well this subject.

I have to advise you to accept the two phase plan, though it would be much more for my personal interest if you would decide for the three phase. I shall explain this to you when I next have the pleasure of meeting you.

Yours sincerely

N Tesla.

Excuse in haste

WHT/tmsxf

U. S. Circuit Court,

EASTERN DISTRICT OF PENNSYLVANIA.

TESLA ELECTRIC CO. vs. SCOTT & JANNEY ET AL.	No. 28 April Sessions 1897 In Equity.

KERR, PAGE & COOPER, for Complainant.
ALBERT H. WALKER, for Defendants.

MCPHERSON J.

The defendants are charged with infringing letters patent Nos. 511,915, and 555,190, granted to the plaintiff as assignee of Nikola Tesla. The patents relate to electro-magnetic motors operated by alternating currents of electricity, and the points in controversy cannot be understood without a brief preliminary consideration of certain properties manifested by the electric fluid. I condense the following account from the brief of plaintiff's counsel, understanding that no objection is made by the defendants to the accuracy of the theory now to be repeated :

Suppose two coils of insulated wire, A and B, to be wound in opposite directions and placed at two points on a soft iron bar, C. If a current of electricity be passed thro either coil, or thro both coils, the bar will become a magnet for the time being. If a current of

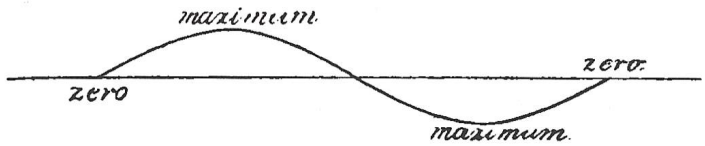
Polyphase Motor Case, Complainant Tesla Electric Company, April 1897
University of Michigan Library

given direction be passed thro coil A alone, a north pole will be thus produced at one end of the bar, and a south pole at the other end. The same current passed thro coil B alone will also produce north and south poles, but in reversed positions. If the same current be passed thro both coils at the same time, a north pole will be produced in the bar midway between the coils. If the current thro coil A is weaker than the current thro coil B, the stronger current will have more influence upon the position of the pole, and will fix it nearer to A than to B. If the stronger current be shifted from A to B, the position of the pole will also be shifted to a point nearer to B than to A; and thus, by increasing and decreas- from zero to maximum the relative strength of the currents through the respective coils, the pole may be made to travel backward and forward from one end of the bar to the other. If, therefore, a magnetic bar or armature, D, be suspended near the bar, and be free to move, it will inevitably follow the pole in this backward and forward movement. The bar need not be continuous, and need not be straight; it may be bent into the form of a ring. Soft iron forms a better path for the magnetic lines that flow from the coils, than the air affords; but the lines will pass thro the air for some distance, and therefore the middle section of the bar may be removed, leaving only the sections that are surrounded by the coils, or the bar may be removed altogether. In either event the armature D will still be affected magnetically, while its movement may be less obstructed. The partial removal of the bar may therefore be an important physical advantage. The movement of the armature will depend upon the relative strength of the magnetizing influences of the coils, and upon the forces that may be set in motion by these influences.

If, therefore, the pole is to shift uniformly, and is thus to produce a uniform magnetic attraction, the electric current passing thro each coil must vary in

strength, and must vary uniformly. There must be a definite relation between the two currents, and this relation must be constant in all the changes in strength that the currents undergo. Tesla discovered—and the discovery has been of vast importance—how to use alternating currents of electricity so as to bring about this uniform shifting of the poles or attractive forces in a motor, and thus to cause the rotation of an armature, and the consequent transmission of power.

A continuous current of electricity flows in one direction only and in its course does not vary much in strength. An alternating current flows backward and forward, and in its course varies in strength four times between zero and maximum. It being at zero, increases in a given direction to maximum, decreases again to zero, increases to maximum but now in the opposite direction, and finally decreases once more to zero. The following curve will serve to illustrate what takes place;



The application of alternating currents in the operation of motors will be best shown by examining another of Tesla's patents, No. 381,968. Figure 3 of this patent shows a generator of alternating currents, and a motor connected therewith. In this motor the soft iron bar C is bent into the shape of a ring, around which are wound two pairs of magnetizing coils A and B, arranged alternately. The armature D is centrally mounted within the ring, and is free to revolve upon this central axis. If a current be passed through coil A alone, a horizontal line of polarization will be developed in the core C. A similar current through coil B alone will develop a vertical line of polarization, while currents of equal strength passed through both

sets of coils at the same time will produce a resultant line of polarization that will be diagonal in direction, midway between the horizontal and vertical lines. If the two currents be applied at the same time, but varying in strength and direction, the poles will travel around the ring, and the shifting magnetic attraction, or rotating field, will draw the armature after it. The necessary variations in the strength and direction of the two currents are produced in the generator. What takes place there is thus detailed in the account I have been following:

"E and F in said generator are two field-magnet poles, G a cylindrical armature mounted to rotate between them, and H K two coils wound on the armature at right angles to each other.

"It is well known that when any coil is moved in a magnetic field so as to cut, at right angles, the lines of force extending between the poles, a current is developed in the coil, which depends for direction upon the direction of movement of the coil with respect to the magnetic lines, and for strength or potential upon the number of lines cut per unit of time.

"In any given generator, therefore, such as that of Fig. 3, in which the magnetic lines may be assumed to extend across, in parallelism, from one pole to the other, an armature coil H moving through such a field in a circular path will, at one instant of time, cut no lines of force, since its direction is parallel to the direction of the lines. At such instant the coil is developing no current, and is said to be in the neutral position.

"At another point in its path, 90 degrees from the neutral point, the coil is cutting the lines of force at right angles. It is then said to be in the maximum position, because its direction is such as to cut the greatest number of lines per unit of time, and, therefore, to produce the maximum current. At every intermediate point in its path, from the neutral to the maximum points, it is evident that the

coil will cut a gradually increasing number of lines of force in a given angular movement, and will in consequence develop a current which rises from zero to maximum.

"The coil, in passing beyond the maximum point, develops gradually less current until it reaches a point 180 degrees from the start, where it is again said to be at the neutral point, and its current is *nil.* In moving through the next 180 degrees of arc, the action above described is repeated, but the direction of current is reversed, since the coil is moving in the opposite direction across the lines of force. When the coil has returned to the assumed starting point, it has undergone a complete cycle of changes, and a current has been developed which, in potential and direction, corresponds throughout to the position and movement of such coil. These cycles of current may, therefore, be regarded as divided into 360 degrees, and we may express the relations of any two of such currents by a statement of their relative displacement as measured by such a scale. Thus, two currents are said to be *in phase,* when they rise and fall simultaneously, and in the same direction. They are said to differ by 90 degrees, or a quarter of a cycle or phase, when one begins to rise from zero positive at the instant that the other begins to fall from maximum positive, and so on.

"In the generator under consideration the coils H and K, having an angular displacement of 90 degrees will generate alternating currents differing by 90 degrees, or a quarter phase ; or, in other words, the periods of maximum current in one coil coincide with those of minimum current in the other, and conversely. If, then, the generator coils K and H be connected in circuit with motor coils A and B, respectively, the resulting action will be as shown in the accompanying series of figures :

"Starting with the generator coils in the position indicated in Fig. 3, the current in coil H is practically *nil ;* whereas, the coil K is at the same time develop-

ing its maximum current; and, since the last-named coil is in circuit with motor coils B, a magnetization of the ring C results, the poles being in a vertical line N, S.

"When the generator coils have made one-eighth of a revolution and reached the position indicated in Fig. 4, both will be generating currents, which, owing to the position of the coils in the field,

FIG. 4.

will be of equal strength. Both pairs of motor coils A and B will, therefore, receive equal currents; and the poles, resulting from the conjoint magnetizing effect, will have advanced along the ring to a position corresponding to one-eighth of the revolution of the armature of the generator.

"In Fig. 5 the armature of the generator has pro-

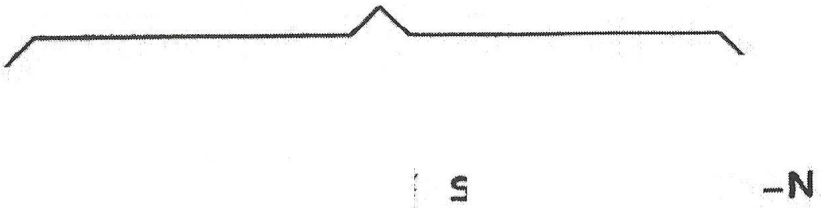


FIG. 5.

gressed to one-quarter of a revolution. At the point indicated the current in the coil H is maximum, while in K it is *nil*, the latter coil being in its neutral position. The poles of the ring will in consequence be shifted to a position 90 degrees from that at the start, as shown. In like manner the conditions existing at each successive eighth of one revolution are shown in the remaining figures, a short reference to which will suffice for an understanding of their significance. Fig. 6 illustrates the conditions which exist when the generator armature has completed three-eighths of a revolution. Here both coils are generating current, but the coil K, having now

Fig. 6.

entered the opposite field, is generating a current in the opposite direction, having the opposite magnetizing effect; hence, the resultant pole will be on the line N S, as shown. In Fig. 7 one-half of the revolution of the armature of the generator has been completed,

N

Fig. 7.

with the resulting magnetic condition of the ring as shown. In this phase coil H is in a neutral position, while coil K is generating in maximum current, which is in the same direction as in Fig. 6. The poles will consequently be shifted through one-half of the ring. In Fig. 8 the armature has completed five-eighths of a revolution. In this position coil K develops a less powerful current, but in the same direction as before. The coil H, on the other hand, having entered a field of opposite polarity, generates a current of opposite direction. The resultant pole will, therefore, be in the line N S; or, in other words, the poles in the ring will be

Fig. 8.

shifted along five-eighths of its periphery. Fig. 9 in the same manner illustrates the phases of the genera-

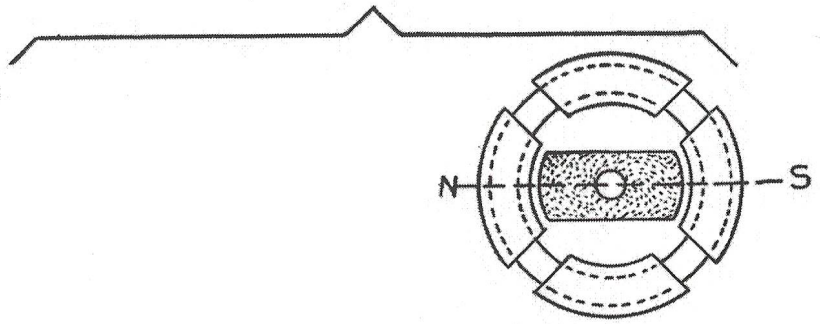


Fig. 9.

tor and the ring at three-quarters of a revolution; and Fig. 10, the same at seven-eighths of a revolution of the generator armature. . . . . .

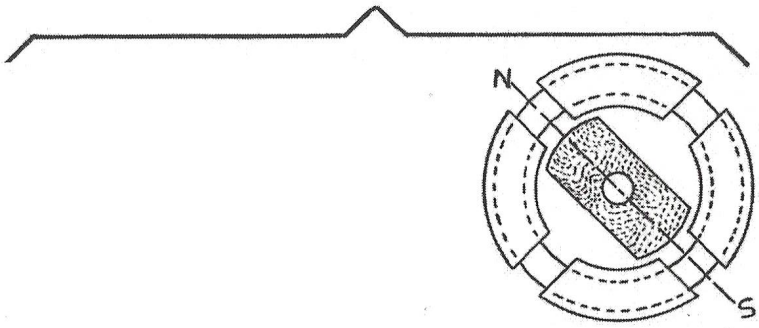


Fig. 10.

When a complete revolution is accomplished, the conditions existing at the start are re-established, and the same action is repeated for the next and all subsequent revolutions, and, in general, it will be seen that every revolution of the armature of the generator produces a corresponding shifting of the poles or lines of force, around the ring.

"As the poles of the motor shift, the armature follows; and it will be seen that in any motor in which a progressive shifting of the poles or points of attraction is produced, there must be a constant drag or pull upon the armature tending to set and maintain it in rotation."

As already stated, a continuous bar or ring is not essential, and therefore a rotating field may be produced in a motor of the form shown on page 11 of the brief.

FIG. 11.

"This motor has four poles, 1, 2, 3, 4, projecting inwardly from a ring C, which may be of iron, brass, wood or any other material. The poles 1 and 2 are energized by coils A, which are in one of the circuits from a generator of the same construction as that above described, while poles 3 and 4 are energized by coils B in the other circuit of said generator. The currents in the two circuits differ by a quarter-phase.

"In such a motor the coils A at a given instant are receiving the maximum current from the generator; and, we will assume, are imparting to the cores which they surround the maximum magnetization. At this moment the poles 3 and 4 will be neutral, since no circuit is following in the coils B. An armature D, therefore, will tend to place itself in the path of the greatest number of magnetic lines, or, obviously, in line with poles 1 and 2."

"Following the phases of the two currents, however, the magnetism of the poles 1 and 2 then decreases, while that of poles 3 and 4 increases, with the result that the attraction of poles 1 and 2 for the armature becomes less, while that of poles 3 and 4 becomes greater, and the armature turns in obedience to the shifting resultant of these two forces. Then, with a change of polarity, the rise and fall of magnetism in

the two sets of poles respectively continues, as will now be understood."

What has been said will explain Tesla's theory of polyphase alternating current motors.

"His broad invention expressed in a few words, was the production, by means of two or more alternating currents, differing in phase, of a shifting or rotating magnetic field, as distinguished from one in which the poles, or points of maximum attraction, were merely alternated in polarity either with or without variation in strength.

"In other words, if the two alternating currents which energize such a motor as that shown in Fig. 11 were exactly in phase, or, what would be the same thing, if the motor were energized by a single alternating current, the magnetism of the poles would rise, fall and reverse at the same instants of time. Such a motor is capable of maintaining rotation of the armature if the latter be brought, by the application of power, up to a speed corresponding to the rate of alternations of the energizing current. But such a motor will not start from a state of rest, because there is no rotary effort, or torque, exerted by the field upon the armature, but only a force tending to keep the armature in a fixed position with relation to poles of given sign.

"The moment, however, that a time interval occurs between the periods of magnetization of adjacent poles, such as would result from energizing such poles by currents differing in phase or any other cause, a rotative tendency is created, due to the shifting or swinging of the magnetic resultant from that pole which reaches its maximum first towards that which reaches it later."

The effect produced by such a motor is the same as would be produced if the poles of permanent magnets were presented to the armature, and the magnets themselves were revolved bodily around it.

The attraction between the armature and the rotating magnetic field may be intensified by placing on the

armature itself closed, or short-circuited coils. The nearness of the magnetic field will induce currents of electricity in those closed coils, which will thereupon magnetize the armature, and increase the attractive effect between the armature and the field. This feature is a subject of patent No. 382,279 (not now in dispute), and may be further explained as follows:

FIG. 12.

"Let A, in Fig. 12, designate a magnetic body mounted on a central shaft and having a number of polar projections B, each of which is surrounded by a short-circuited or closed coil or conductor C. Let D represent a permanent magnet having a north and a south pole N S. If now the magnet D be moved rapidly around the periphery of the magnetic body A in the direction of the arrow while A is held stationary, it is obvious that the passage of its poles in front of the polar projections B will cause lines of force to pass into and out of the projections, and these lines threading the closed coils C will develop electric currents in said coils. This is what happens in any magneto-electric generator in which the armature coils are moved through the magnetic lines of the field, or the latter are moved through the coils."

"The currents dveloped by this means will magnetize the cores which the coils surround, and as the development of such currents and the resulting magnet-

ization cannot occur simultaneously with the passage of the poles, but must lag somewhat after it, there will always be magnetized portions in the armature behind the moving poles, and endeavoring to catch up with them. If the armature be free to rotate, there will be between the magnetic poles in the armature, due to the currents induced in the closed coils and the moving poles of the magnet D, a torque or mutual attraction tending to produce rotation very much greater than would exist between the magnet D and the armature A if the coils C were not present.

"If, instead of moving modily a magnet D around the armature, its action be imitated by the shifting poles in a ring, or the shifting resultant between polar projections produced by two alternating currents of different phase, the same result would follow, and we should have the highest development of the Tesla motor."

In such a motor as has now been described, the most favorable condition for operation exists, when the two currents differ in phase by ninety degrees, or a quarter of a period. To obtain this condition, the currents must proceed from independent sources; they may proceed from different machines, or from different coils in the same machine. In the patents of May 1, 1888 preceding those in suit, the currents were furnished by two complete circuits extending from the generator to the coils of the motor. At that time, however, all alternating-current apparatus was designed for a single circuit, and therefore a Tesla motor could not be used with such apparatus. In order to meet this objection, Tesla devised several schemes by which his motors could be operated by a single circuit. He proposed to split a current into two currents, and to produce a sufficient difference in phase between them to secure the necessary rotating field. For present purposes, only two methods of obtaining the desired result need be considered:

"I. Splitting a single current into two currents, and obtaining the requisite difference of phase by induction.

"II. Splitting a single current into two currents by dividing the path of a single current, and obtaining the requisite difference of phase by making the two branches of the main path of different electrical character."

The first method is thus explained:

"If a current be flowing in a conductor, it sets up in the vicinity of such conductor a condition known as a field of force. If another conductor be placed within the influence of this field of force, and parallel to the first, a current will be developed, or induced, in it by any change that takes place in the strength of the current in the first. But such induced current will not be in phase—that is, in step with the changes in the original current—for the reason that the force which causes it to flow is in proportion to the rate of change of the original force. There are obvious complex considerations attending this phenomenon, but for present purposes it is sufficient to accept the general proposition that, whenever one conductor is brought within the inductive influence of another, any change in the current in one conductor induces a current in the other with corresponding but later changes.

"Tesla conceived the idea of utilizing this law for the production of a rotating field motor capable of being run from a single circuit.

"Applying this principle to the operation of his motor, he connected one of the energizing circuits directly with the main circuit of a single-phase generator, and near the motor formed the wire of the main circuit into a coil, which he surrounded with a second coil connected with the other motor circuit. By this means, there was induced in the second motor circuit a current similar to that which flowed through the first circuit directly from the main line, but later in phase, and, as explained above, this would necessarily result in the operation of the motor."

The second method is as follows:

"A circuit offers to the passage of an alternating current two kinds of resistance—one known as dead, or ohmic, resistance, the other known as live, or active, resistance. The first is dependent solely upon the length and area of cross-section of the conductors forming the circuit, and upon their specific resistance; that is, upon the kind of metal or material of which they are composed. Copper, for instance, has a low specific resistance, while German silver has a high specific resistance; which simply means that for a given length and cross-section of conductor formed of the two metals, copper will oppose to the passage of the current a much lower dead resistance than will the German silver.

"Active or live resistance is of an entirely different character, and is the result, to use a rough analogy, of a sort of inertia which is characteristic of the circuit, and which varies with the arrangement. To carry the inertia analogy still further, it may be said to be comparable to the inertia resistance which is opposed to the attempt to move suddenly on its hinges a heavy door. It is a commonly-observed fact that if an attempt be made to push open a heavy door, however free from friction its hinges may be, the door will not immediately move in response to a pressure exerted upon it, but the motion will lag behind the pressure exerted; but, having once begun to move, it will continue to swing and will resist an attempt to stop it, so that a pressure in the opposite direction must be exerted for some little time before the motion of the door is reversed. If an attempt were made to swing such a door back and forth, its motion would always lag behind the pressures exerted upon it.

"In a similar or analogous manner, when an attempt is made to send a rapidly-varying alternating current through a circuit, the circuit at first resists the flow of the current; and, the current having once started, the

circuit resists any change in its strength or direction. This property of a circuit is known as self-induction. It results, therefore, that, where self-induction exists in a circuit, there is a delay, or lag, or displacement of phase, between the current flow and the pressure tending to produce it, and this delay is due to the live resistance, or electro-motive force of self-induction. The analogy just used may be carried still farther, and the dead resistance of the circuit may be compared to the friction of the hinges. If there were no resistance opposed to an attempt to move the door except the friction of the hinges, the door would begin to move the instant a pressure greater than the friction were exerted, and would stop when the pressure ceased; and, in a similar way, the dead resistance of the circuit opposes no varying resistance and does not delay the current. If the door have both a large inertia and a large friction, the inertia resistance or active resistance will be proportionately less, and a proportionately less force will be exerted in starting it, and it will continue to swing for a shorter time after the force is removed; that is, it will stop quicker; its delay will, therefore be less. In a somewhat analogous manner, an increase of the dead resistance of a circuit will make the effect of its active resistance relatively less, and the delay or lag of the current, less.

"Tesla also conceived the possibility of utilizing these facts in the production of a rotary field motor capable of being run by a single circuit, and carried out this conception by dividing a single circuit of alternating current into two branches at the point where the motor was located, and using these two branches as independent circuits to energize the motor. Then, in order to secure a difference of phase between the currents flowing in said branches, he made them of different electrical character; that is to say, by the introduction of some means in one to increase

its self-induction or inertia, he retarded the current therein to a greater degree than in the other."

This brings us to the patents in suit, which have to do with "split-phase" motors. The applications were made, and the patents were granted, on the following dates:

No. 555,190, for an alternating motor, was applied for on May 15, 1888, and was granted Feb. 25, 1896.

No. 511,915, for a method of electrical transmission of power, was applied for on May 15, 1888, and was granted Jan. 2, 1894.

The patents stand upon the same application, which was divided in Dec. 1888, and are attacked together on the ground that they are void for want of invention. It is argued that in view of the prior state of the art, and especially in view of Tesla's patent No. 382,279 of May 1, 1888, the step from obtaining separately from the generator the two alternating currents, different in phase, that are required to operate the motor described in No. 382,279, to obtaining only one of such currents from the generator, while the other is obtained by induction from the primary current, was an obvious step, easy to be taken by any one possessed of skill in electrical engineering, and therefore did not involve invention. Upon this point, the opinions of the experts do not agree, and I am so little of an expert myself in this difficult branch of science, that I scarcely feel entitled to have or express an independent opinion. Nevertheless, I have given the subject such consideration as lay within my power, and have come to the conclusion that the step was taken in the exercise of invention. The grant of the later patents is *prima facie* evidence of novelty and utility, as has often been decided; but, aside from this presumption, so far as I can realize the situation before and after May 1, 1888, the two patents now attacked seem to me to be so connected with the earlier group, that the same faculties that were necessary to produce those that are first in point of time must have

continued in exercise to produce those that followed. It is often very difficult to draw the line between invention and skill, and different minds may draw it at different points. I submit my own conclusion for what it may be worth.

Another defence asserts that the disputed claims No. 555,190, are invalid, because they are identical with the claims of No. 445,207. If the claims in both patents are for the same inventions, the position is sound; for No. 555,190, altho first applied for, was not granted until more than five years after No. 445,207. But I do not think the inventions are the same. The claims are certainly not expressly alike, as will be seen at once; and their identity must be found, if at all, in what is implied by the claims of No. 555,190. Upon this point, the testimony is in conflict; and my examination of the opposing views has led me to the conclusion, that the defendant's position has not been sustained. I think the plaintiff's argument is sound, as thus expressed on page 42 of the brief:

"The distinction between the inventions claimed in these two patents resides in the fact that in No. 445,-207 the two circuits of the motor are, as stated in claim 1, of different electrical character or resistance; in claim 2 they are of different self-induction, while in claim 3 one set of the energizing coils is formed of conductors of small size and few turns, while the other is a conductor of larger size. None of these three requirements is found in either of the claims of Patent 555,190, and, therefore, the two patents are not for the same invention. Moreover, while it is true that claims 1, 2 and 6 of Patent 555,190, which are the claims relied upon by the complainant herein, do cover the construction set forth in Patent 445,207, yet, on the other hand, the invention of said claims can be embodied in motors which do not contain the invention claimed in Patent 445,207, because it is quite possible to make the circuits of the motor of 555,190 of the

same electrical character or resistance and of the same self-induction, since the difference in phase in such a motor would be secured by the induction of one current from the other. In fact, the motor shown and described in Patent 555,190 does not embody the inventions of the claim of Patent 445,207."

Another defence sets up Patent No. 511,559, granted Dec. 26, 1893 (not hereinbefore referred to) as a sufficient answer to the validity of No. 511,915, granted Jan. 2, 1894—the position being, that both patents are for the same invention, and therefore that the patent later in date is void. This defence was not set up in the answer, and for this reason objection is made to its consideration. It is not necessary to pass upon the objection, however, since I do not think that the defence should prevail. The claims of No. 511,559 are as follows:

"1. The method of operating motors having independent energizing circuits, as herein set forth, which consists in passing alternating currents through both of the said circuits, and retarding the phases of the current in one circuit to a greater or less extent than in the other.

"2. The method of operating motors having independent energizing circuits, as herein set forth, which consists in directing an alternating current from a single source through both circuits of the motor, and varying or modifying the relative resistance or self-induction of the motor circuits, and thereby producing in the currents differences of phase, as set forth."

And the disputed claim of No. 511,915 is in this language:

"1. The method of operating electro-magnetic motors having independent energizing circuits, as herein described, which consists in passing an alternating current through one of the energizing circuits, and inducing by such current the current in the other energizing circuit of the motor, as set forth."

I think the earlier patent claims, 1. A generic method of operation by difference of phase; and 2. A specific method of obtaining that difference, namely: by "varying or modifying the relative resistance or self-induction of the motor circuits"; while the disputed claim of No. 511,915 claims a different method of obtaining the difference in phase, namely; by induction. As already pointed out, induction and self-induction are different things.

The last defence is non-infringement. To this point, much of the testimony has been directed, and the subject has received the most careful attention in my power. It has not been easy to understand, as will immediately appear to any one who undertakes its examination. The defendants' counsel describes it as "one of the most abstruse departments of electricity," and he rightly speaks of the principal testimony on this point as "two elaborate and highly technical scientific expositions." Fortunately, the oral arguments and the briefs of counsel have presented the opposing views with such admirable clearness and force, that I think I have been able to understand the disputed points sufficiently to choose between the antagonistic theories. The difficulty is of course increased by the fact, that the operations of the electric fluid are not visible; we see only the phenomena that result from such operations, and can only form an opinion, more or less probable, concerning the actions and reactions that cooperate to produce the phenomena. Upon many points, opinions agree; upon other points, there is at present a wide divergence. Such divergence exists among the witnesses who have testified concerning the electrical and magnetic forces that combine to cause the armature of the defendants' motor to revolve, and I cannot give the reasons by which they support their respective conclusions without quoting their precise and condensed language at such length as would unduly extend this opinion. The defendants' expert concludes that the motor is operated (D. E. p. 78) by

" the mutal action between the field set up by the copper band H " (which encloses one of the pole pieces of the field magnet) " and the field set up by the current in the armature circuit F, under that part of the field magnet marked D ". On the other hand, the plaintiff's experts conclude that the motor is operated by the progressive shifting of polarity that is the characteristic effect of a Tesla motor, and that such shifting is produced by substantially the same arrangements in the one case as in the other.

As already indicated, I am of opinion that the plaintiff's theory of operation is correct, and I cannot do better than state it in the language of counsel. The defendant's motor is thus described :

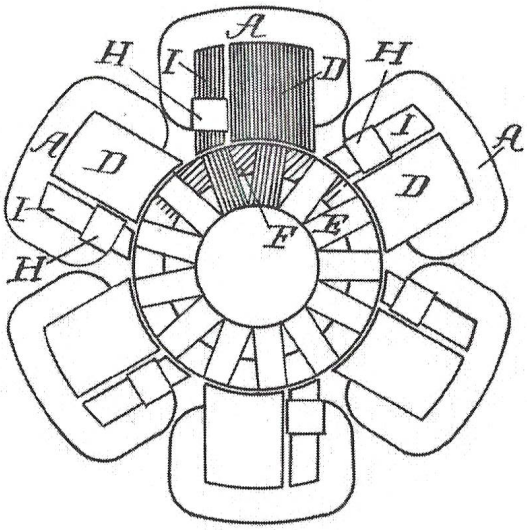


Fig. 13.

" The infringing apparatus is au alternating-current motor. Two forms and sizes of this motor, as made by the defendants, are in evidence, but, as the experts for both sides agree that they differ only in structural details, but one form will be considered.

" The motor in general appearance, is of cyndrical

form, with a shaft passing axially through it and carrying a fan at one end. An inspection of the outside cylindrical portion of the motor proper shows it to consist of laminated magnetic cores composed of bundles of iron plates disposed in a circle parallel to the shaft, and which in the small motor, are six in number. The arrangement of these bundles of plates is roughly analogous to that of the staves of a barrel.

"The cores have at each end inwardly extending polar projections, radial with respect to the cylindrical outline which the group as a whole presents. On each of the cores or bundles of plates which constitute elements of this cylinder, and between the polar projections of the same, are wound coils of wire which produce magnetic poles of opposite sign at the polar projections; and the coils of the several elements of the cylinder are so wound and connected that, when joined to the supply circuit and traversed by a current impulse of given direction, they produce alternately opposite poles in the circumferentially successive polar projections. These coils, when joined up together, constitute the main or primary energizing circuit of the motor, which receives current from an external source.

"Each of the bundles or cores is divided throughout its length into two parts, and the polar projections of the smaller parts are surrounded by conductors in the form of a coil of a single convolution, and composed of flat copper bands, the ends of which are soldered together, so that each constitutes a short-circuited, or closed, conducting path around one of the two polar projections into which each of the cores is divided.

"The secondary element or armature of the motor is composed of a circular series of bundles or iron plates, thirteen in number, arranged around the shaft and parallel thereto. Each of said bundles or cores has polar projections at its ends extending radially outward, and surrounded by closed conductors or coils

formed of copper cylinders with longitudinal slots through which the polar projections extend. The copper cylinders resemble in form the rotating portion of a squirrel cage, and this form of winding has long been known as a 'squirrel-cage' winding. The motor is in all respects substantially the same in construction as the fan-motors made by the complainant's licensees, and is a slavish copy of a form of motor patented in 1895 by the Westinghouse Co. hereinafter referred to."

The plaintiff's thereory of operation is as follows:

"Assume, therefore, that the motor be connected with the circuit of a generator so that alternating currents flow through all the main or primary coils AA surrounding the field cores. In the absence of any disturbing causes, the polar projections I and D would, in consequence, exhibit magnetic phases corresponding to those of the currents producing them; that is to say, the magnetism of each pair of polar projections would simultaneously rise, fall and reverse, while at any given instant of time the polarities of circumferentially successive pairs of polar projections would be of opposite sign. This would exert no rotative effect upon the armature, whether the latter were provided with closed coils on its polar prtjections or not; for, as explained above, we would then have the conditions which obtain in the ordinary single-phase synchronous motor, in which the armature must be brought up to a speed corresponding to the rate of alternations of current producing the field, before it can rotate in obedience to the magnetic actions of the field.

"But the armature of the defendant's motor *does* start from a state of rest, and runs up to full speed even when run by a current of 16,000 alternations per minute, so that there must be present some conditions other than those due to the simple alternations of its poles, and it only remains to determine what those conditions are.

"It is evident that a current which passes from an

outside source through any of the coils A A magnetizes both of the cores surrounded by such a coil. In other words, it creates a magnetic field which passes through both of the polar projections of the compound core energized by such coil; that is, through the polar projection D, which is not surrounded by the copper band, and through projection I, which is.

"It is further evident that the passage of the lines of force through the plane of the closed circuit which is afforded by the copper band H must result in the development of a current in such band, which will not be in phase with the primary current, but will follow it, rising from zero to its maximum, and then falling and reversing later than the current in coil A, by which it is produced.

"But the existence of a current in a closed conductor or coil necessarily implies the creation by such current of a field of force, and, if the coil surround a magnetic core, the magnetization of such core. This is what happens in the present case; but, as the current in the copper band H is later than that in the wire coils A, the magnetization which it imparts to the portion of the core I which it surrounds, is later in time than that developed by the wire coil.

"The fact that a current is developed in the copper band H also implies, and of necessity involves, the transformation of a portion of the energy of the magnetic field produced by the coil A into such a current. In other words, a portion of those lines of force, which would otherwise pass into the smaller polar projection I and be there immediately manifested in its magnetization, are absorbed by the copper band and converted into current. Hence the initial magnetization of the smaller projection will be weaker than that of the larger projection, in proportion to the number of lines that have been taken up by the copper band, so that not only the maximum, but also the minimum, magnetizations of the smaller projections I will occur at later

periods than the corresponding phases of the larger ones D.

"We have, therefore, in defendant's motor a series of pairs of poles, each pair consisting of a large polar projection D and a smaller one I, the periods of magnetization of which do not accord in point of time, for the phases of the smaller projections follow after those of the larger. These are the conditions of a rotating or shifting field, and they are produced by the conjoint action of two alternating currents of different phase, one of which is induced by the other.

"It being incontestably true that, as between any two pollar projections of the same compound core, there exists a time difference in the phase of magnetism which they exhibit, it will readily be seen how such conditions result in the rotating or shifting magnetic field of the Tesla patents. For, assume that this time difference were equal to one-quarter of a complete cycle of change, which is the ideal condition of operation. Then, when any given polar projection D exhibits maximum magnetism of one polarity, the adjacent projection I, which is surrounded by the same wire coil, will have practically no magnetism. As the strength of D decreases, that of I increases, until the first becomes *nil* and the second reaches its maximum.

"The magnetism of the first then rises from zero to a maximum in an opposite direction, while that of the second or smaller is falling from maximum to zero, but without change of direction. Next the first falls from maximum to zero while the second rises from zero to maximum, but with the same direction now as the first, and so on.

"Under these conditions it is obvious, that the resultant attractive effect of any pair of projections will shift or swing from that pole which is first to reach its maximum towards that which is later; and, having regard to the polarity of this resultant, it will be seen that, after shifting from a larger projection D to its smaller companion I, it then shifts from the latter to

the larger projection D of the next adjacent pair, and so on through the whole series around the armature, in exactly the same manner as takes place in any Tesla motor having more than two single or double poles.

"To explain this further; when the resultant, which is, say, or north polarity, has shifted from a larger to a smaller projection, the latter is maximum north, and the former is zero and just about to change, but the larger projection D of the pair next adjacent on the side of the smaller projection I, now at its maximum, is also zero and just about to change. Its change, however, will be from south to north, or to the same polarity as that exhibited by the smaller projection I of the first pair; hence, the north resultant will continue to shift from the said smaller projection I over to the larger projection D of the adjacent pair, while a south resultant will at the same time shift from the larger to the smaller projection of the first pair.

Each pair of projections may be regarded as constituting an independent couple, all of which, however, co-operate, one couple taking up and carrying on the resultants that have shifted between the members of the couple preceding it. This is, of course, true of all Tesla motors having more than one couple, as in practice is nearly always the case. And it is also true in cases where the difference in phase between the currents, or the magnetizations resulting therefrom, is not exactly a quarter of a cycle, but something less or more. As explained above, and as stated by Tesla in the patents in suit, the ideal difference in phase of 90 degrees can only be obtained by the employment of independent sources of current; but sufficient difference of phase for all practical purposes is secured artificially in the Tesla 'split-phase' motors and in that of the defendants, and the general law of operation is the same in all cases.

"The shifting or rotating field in the defendant's motor has precisely the same effect on the armature

with closed coils as would result from moving bodily around the armature one or more permanent magnets, as we have explained in a previous portion of this brief."

I think, therefore, that this defense must fail, and that the defendants' motor infringes all the disputed claims of the patents in suit.

The last defence avers that the plaintiff has assigned all its interest in the patents in suit to the Westinghouse Electric Company by an agreement executed July 7, 1888; and, therefore, that the present action cannot be maintained, because the Westinghouse Company has not been joined as a party complainant. This defence was not taken by the pleadings, as it should have been in order to bring it properly before the court, and under the circumstances I am not disposed to give it any weight. Assuming the agreement of July 7 to have the effect contended for, the only result of dismissing the bill would be to renew the controversy in another proceeding, where the same evidence would be heard and the same conclusion would be reached. The failure to make the Westinghouse Company a party plaintiff, if such a joinder was necessary, is a formal defect that has no bearing, so far as has been made to appear, upon the substance of the controversy. But I think it would be reasonable to protect the defendants from the possibility of being called upon to answer that company for the same cause of action, and I understand the plaintiff to agree that the court should take that course. If, therefore, within twenty days from the date of filing this opinion the plaintiff shall file with the clerk a stipulation, executed by the Westinghouse Electric Company, agreeing to be bound by the decree in all respects as if it had been originally a party plaintiff, the decree prayed for by the bill will be entered.

the Henry Ford

Copyright 1895.

Westinghouse Electric & Manufacturing Co.

PITTSBURG, PA.

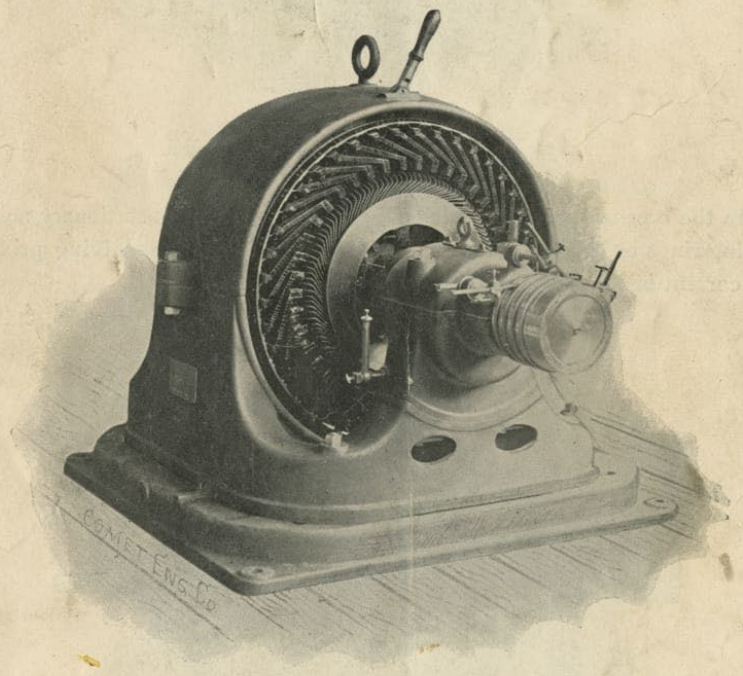
Catalogue No. 94.
Circular No. 3.

Oct., 1895.

Standard Polyphase Tesla Motors.

INDUCTION TYPE.

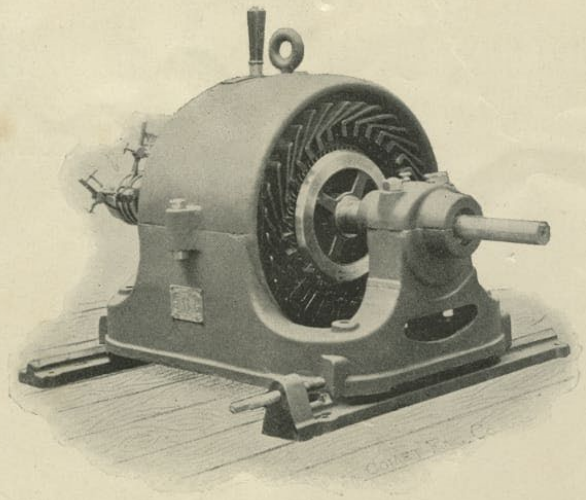
In all Tesla Polyphase motors of the induction type there are two elements—the primary, which is directly magnetised by the current supplied from the circuits; and the secondary, which is traversed by currents of low



100 Horse Power 7200 Alternation Motor.

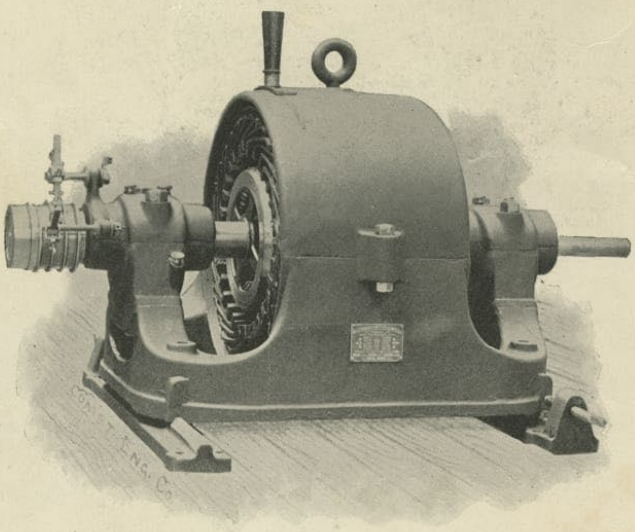
potential induced from the primary. We make these motors with either the primary or the secondary element as the revolving part. In our standard motors of 1 hp, 3 hp and 5 hp the outside, or stationary part of the motor, is the primary, the rotating part being the secondary. Standard motors exceeding 5 hp are usually made with the primary revolving, but we are prepared to furnish motors of the larger sizes with revolving secondaries, if desired.

James J. Wood.



30 Horse Power 7200 Alternation Motor.

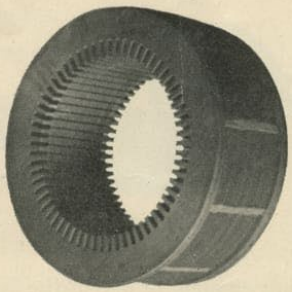
In the type of motor in which the primary element is stationary no collecting rings or brushes are used. In the type having a revolving primary the current is delivered through brushes and collector rings.



25 Horse Power 3000 Alternation Motor.

There is, of course, no sparking whatever between the brushes and the collecting rings in these motors.

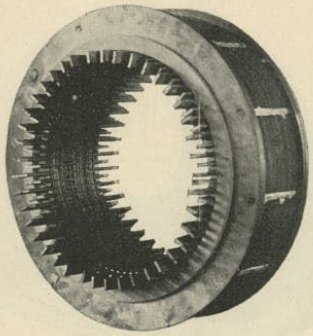
Our Tesla motors operate at very high efficiency throughout their entire working range. In general power distribution, motors frequently operate at less than full load, and high efficiency at partial loads is therefore a great



STATIONARY SECONDARY UNWOUND.

advantage. We are prepared to furnish motors adapted particularly to this class of work, in that their very highest efficiency is developed at somewhat less than their maximum load, thereby securing maximum plant efficiency.

The speed regulation of the motors is extremely close; under full load the fall off from synchronous speed is about 3 per cent. For partial loads their speed is, of course, still nearer synchronism.

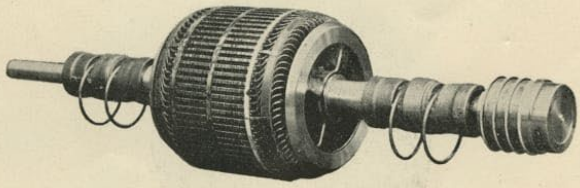


STATIONARY SECONDARY WITH CONDUCTORS IN PLACE.

The construction of the secondary element of the larger motors is illustrated by photographs above, the first of which shows the ring built up of very thin steel plates of the best quality, and thoroughly annealed, with slots ready to receive the conductors; while the second shows a ring with

the conductors in place. These conductors are afterward connected together to form the circuits of the secondary element by means of copper connectors of suitable form, the joints being thoroughly soldered.

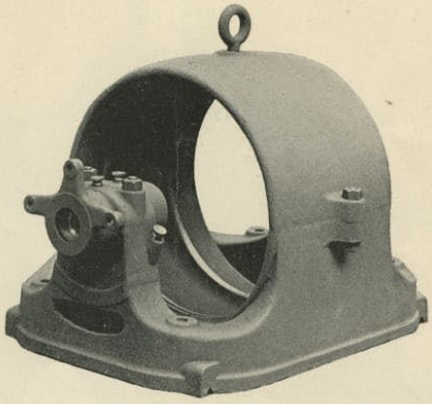
It will be seen that no wires are employed. The conductors are copper bars of rectangular section, great strength, and thoroughly insulated.



REVOLVING PRIMARY.

The primary or rotating element of one of the larger motors is illustrated in the photograph above, which shows also the 3-ring collector, ball bearings, and the rings by means of which the automatic lubrication of the bearings is effected.

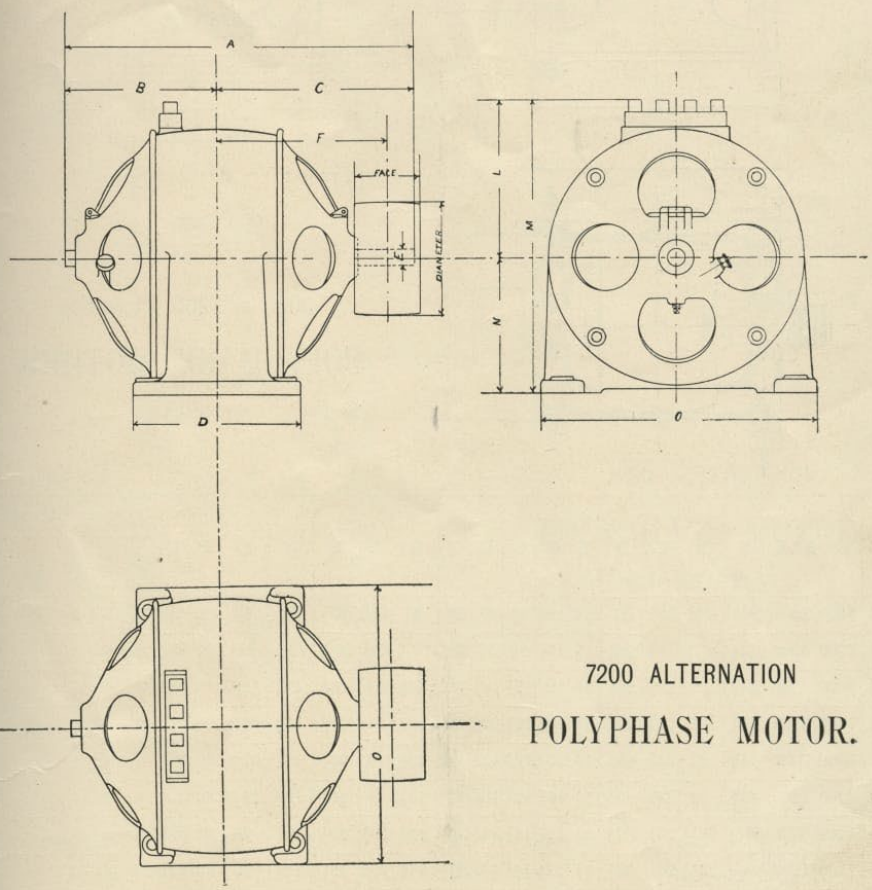
The two elements are mounted in the cast-iron frame shown in the photograph below, and we desire to call attention particularly to the mechanical excellence of this arrangement.



CAST IRON FRAME.

These motors realize the ideal of mechanical perfection. Their cost of maintenance is practically nothing, as they are almost indestructible in ordinary service.

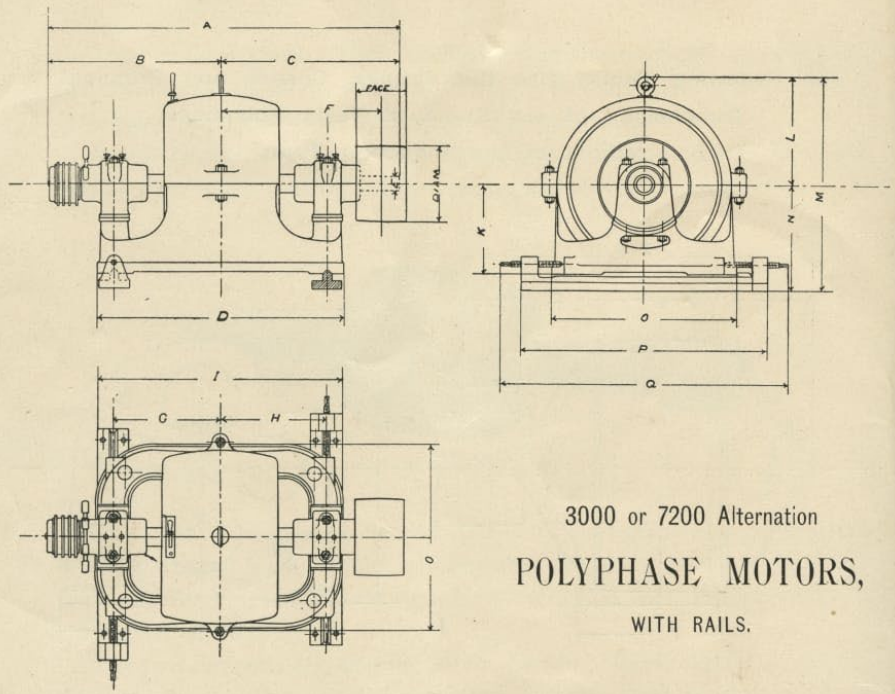
The Following Tables give the Ratings, Speeds and Principal Dimensions of our Standard Tesla Polyphase Motors of the Induction Type.



7200 ALTERNATION

POLYPHASE MOTOR.

HP.	Alts.	R.P.M.	A	B	C	D	E	F	L	M	N	O	Pulley.		Keyway.	
													Diam.	Face.	Width.	Depth.
1	7200	1800	16″	$6\frac{7}{8}$″	$9\frac{1}{8}$″	$7\frac{5}{8}$″	$\frac{11}{16}$″	$7\frac{3}{4}$″	$7\frac{1}{8}$″	$13\frac{3}{8}$″	$6\frac{1}{4}$″	$12\frac{3}{8}$″	5″	3″	$\frac{3}{16}$″	$\frac{3}{32}$″

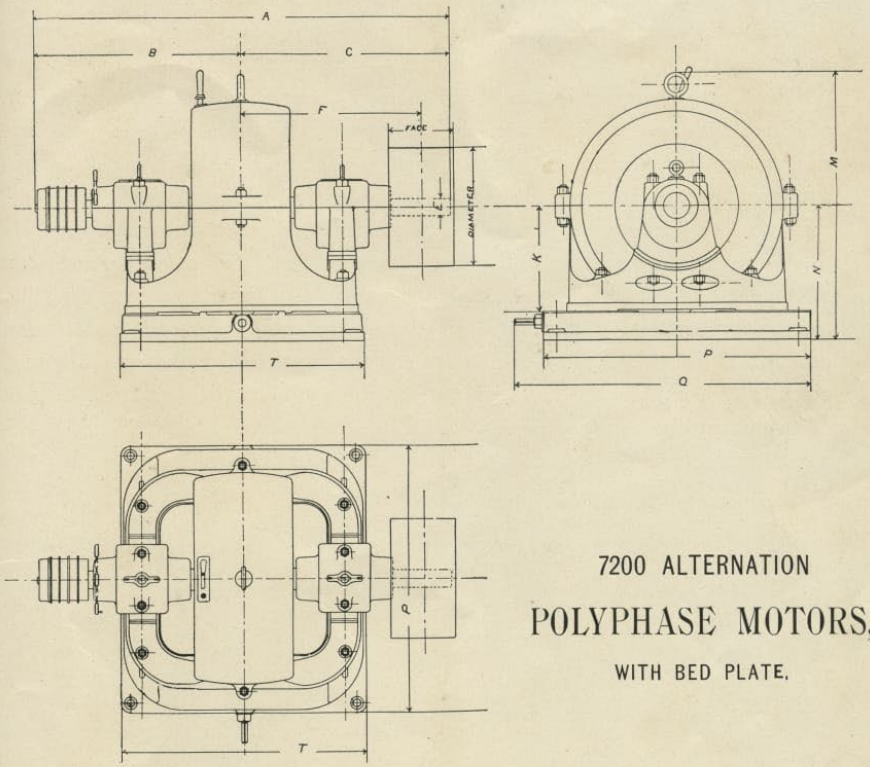


3000 or 7200 Alternation

POLYPHASE MOTORS,

WITH RAILS.

HP.	Alts.	R.P.M.	A	B	C	D	E	F	G	H	I	K	L	M	N	O	P	Q	Pulley. Diam.	Pulley. Face.	Pulley. Length of Hub.	KeyWay. Width.	KeyWay. Depth.
3	7200	1800	28½	13⅛	15⅜	21	1⅜	13⅝	8½	8½	20	8¾	11⅝	21½	9⅞	18	22¼	26	6	3	2	5/16	7/64
5	7200	1200	33¼	14½	18¾	22⅞	1⅝	15⅞	9⅜	9⅜	22½	10 5/16	13½	25 9/16	12 1/16	21¼	30	35½	9	6	4	⅜	⅛
7½	3000	750	44⅜	22	22⅜	29⅞	1⅝	19⅜	12⅞	12⅞	30	10⅞	14	26⅝	12⅝	22 7/16	30	37½	9	6	4	⅜	⅛
7½	7200	1200	44⅜	22	22⅜	29⅞	1⅝	19⅜	12⅞	12⅞	30	10⅞	14	26⅝	12⅝	22 7/16	30	37½	9	6	4	⅜	⅛
10	3000	750	44⅜	22	23⅜	29⅞	1⅝	19⅜	12⅞	12⅞	30	10⅞	14	26⅝	12⅝	22 7/16	30	37½	9	6	4	⅜	⅛
10	7200	1200	44⅜	22	23⅜	29⅞	1⅝	19⅜	12⅞	12⅞	30	10⅞	14	26⅝	12⅝	22 7/16	30	37½	9	6	4	⅜	⅛
15	3000	750	49 13/16	23 15/16	25⅞	32⅝	1⅞	22⅛	14⅛	14⅛	32½	12⅛	15⅝	29½	13⅞	25	33	39¼	11	8	5½	⅝	¼
15	7200	1200	49 13/16	23 15/16	25⅞	32⅝	1⅞	22⅛	14⅛	14⅛	32½	12⅛	15⅝	29½	13⅞	25	33	39¼	11	8	5½	⅝	¼
20	3000	750	49 13/16	23 15/16	25⅞	32⅝	1⅞	22⅛	14⅛	14⅛	32½	12⅛	15⅝	29½	13⅞	25	33	39¼	11	8	5½	⅝	¼
20	7200	1200	49 13/16	23 15/16	25⅞	32⅝	1⅞	22⅛	14⅛	14⅛	32½	12⅛	15⅝	29½	13⅞	25	33	39¼	11	8	5½	⅝	¼
25	3000	750	57⅝	29	28⅝	36¼	2⅜	25½	15¾	15¾	36	14	18⅜	34¼	15⅞	28⅞	40½	47	14	8	6½	⅝	¼
30	7200	1200	57⅝	29	28⅝	36¼	2⅜	25½	15¾	15¾	36	14	18⅜	34¼	15⅞	28⅞	40½	47	14	8	6½	⅝	¼
30	3000	750	62⅛	30¼	31⅞	38½	2⅝	27¼	16¾	16¾	38	15¾	19¾	37⅜	17⅝	32½	40½	48½	15	11	7	⅝	¼
40	7200	1200	62⅛	30¼	31⅞	38½	2⅝	27¼	16¾	16¾	38	15¾	19¾	37⅜	17⅝	32½	40½	48½	15	11	7	⅝	¼
40	3000	750	70	34½	35½	43 1/16	2⅞	30½	18¾	18¾	42	19	24⅜	45¼	20⅞	39¼	47¾	55½	18	13	8	¾	¼
50	7200	900	70	34½	35½	43 1/16	2⅞	30½	18¾	18¾	42	19	24⅜	45¼	20⅞	39¼	47¾	55½	18	13	8	¾	¼



7200 ALTERNATION

POLYPHASE MOTORS,

WITH BED PLATE.

HP.	Alts.	R.P.M.	A	B	C	E	F	K	M	N	P	Q	T	Pulley. Diam.	Pulley. Face.	Pulley. Length of Hub.	KeyWay. Width.	KeyWay. Depth.
75	7200	900	$70\frac{1}{16}''$	$33\frac{7}{16}''$	$36\frac{5}{8}''$	$3\frac{1}{8}''$	$30\frac{3}{4}''$	$21\frac{1}{8}''$	$52\frac{1}{2}''$	$26\frac{1}{8}''$	$54''$	$59\frac{5}{8}''$	$42\frac{1}{4}''$	$18''$	$16''$	$10''$	$\frac{3}{4}''$	$\frac{1}{4}''$
100	7200	720	$81\frac{3}{8}''$	$39\frac{1}{8}''$	$42\frac{1}{4}''$	$3\frac{5}{8}''$	$36\frac{3}{8}''$	$21\frac{5}{8}''$	$54''$	$27\frac{1}{8}''$	$53\frac{7}{8}''$	$59''$	$49\frac{3}{8}''$	$24''$	$12''$	$10''$	$\frac{7}{8}''$	$\frac{3}{8}''$
200	7200	600	$8'\ \frac{5}{8}8''$	$47\frac{3}{4}''$	$56\frac{7}{8}''$	$4\frac{3}{8}''$	$46\frac{5}{8}''$	$28\frac{1}{4}''$	$68\frac{1}{8}''$	$33\frac{3}{4}''$	$70\frac{3}{8}''$	$76''$	$63\frac{1}{4}''$	$30''$	$21''$	$14''$	$1\frac{1}{16}''$	$\frac{11}{32}''$

The photographs on page 2 illustrate two views of the completed motor, the elements of which are shown in the succeeding photographs. The photograph on the first page shows the 100 hp motor.

We wind all of these motors for either two-phase or three-phase currents as required.

The horse-power and general dimensions of our standard motors for each of these two systems are given in the preceding tables. These standard motors are usually wound for a potential of 200 volts. We also wind standard motors not exceeding the 20 hp size for 100 volts, when desired, and in special cases we are prepared to wind motors for other potentials.

We make two separate and distinct lines of Tesla induction motors, one adapted to the 7200 alternation system and the other adapted to the 3000 alternation system. The former is generally used where a considerable amount of lighting is provided for by the same generators and distributing circuits that supply the motors; the latter is used where the principal use of the plant is to supply power, while lighting is merely incidental. We also manufacture Tesla motors of the synchronous type.

WESTINGHOUSE ELECTRIC & MANUFACTURING CO.

Write to our nearest district office.

NEW YORK, 120 Broadway.
BOSTON, Exchange Building.
CHICAGO, New York Life Building.
TACOMA, WASH., 102 S. 10th Street.
PITTSBURG Westinghouse Building.
BUFFALO, N. Y., No. 8 Erie County Bank Building.
PHILADELPHIA, Girard Building.
ST. LOUIS, American Central Building.
CHARLOTTE, N. C., 36-38 College St.
SYRACUSE N. Y., Bastable Building.
SAN FRANCISCO, Mills Building.
WASHINGTON, D. C., 1333 "F" St., N. W.
DALLAS, TEXAS, 416 Trust Building.

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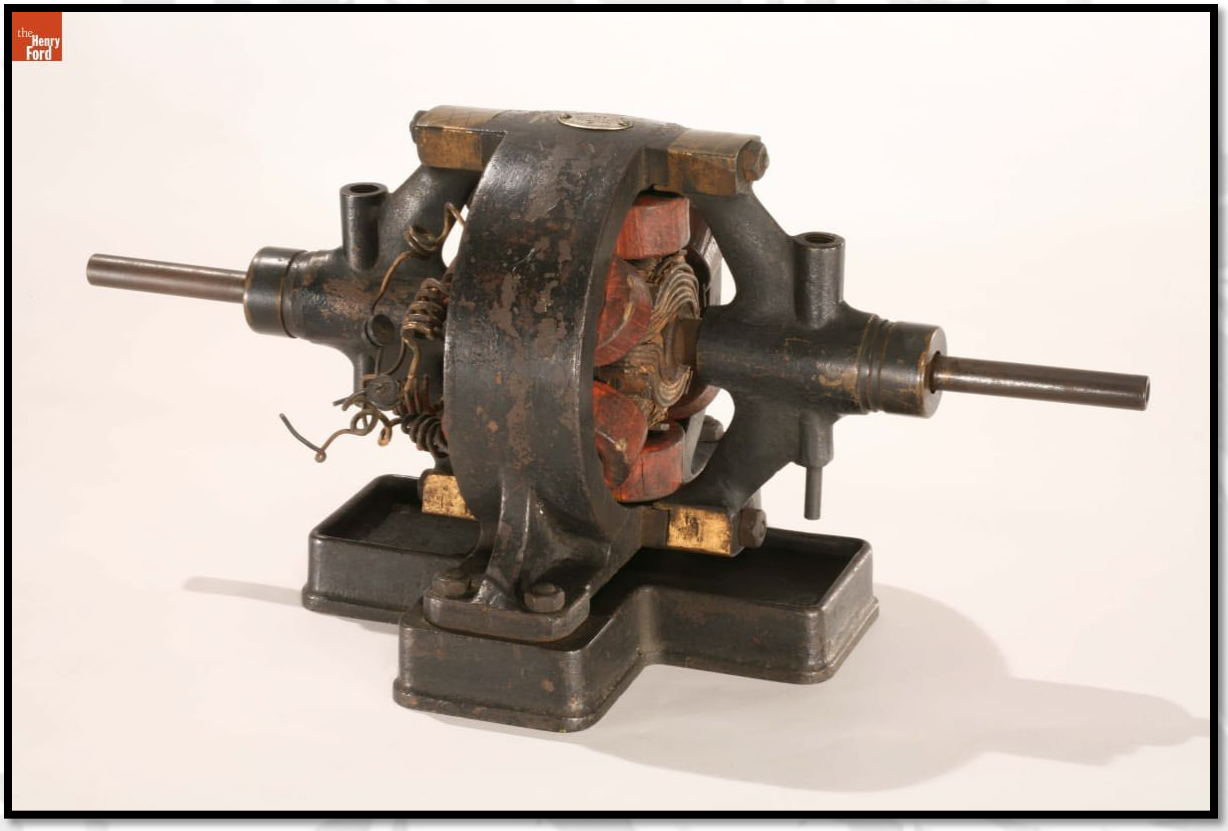
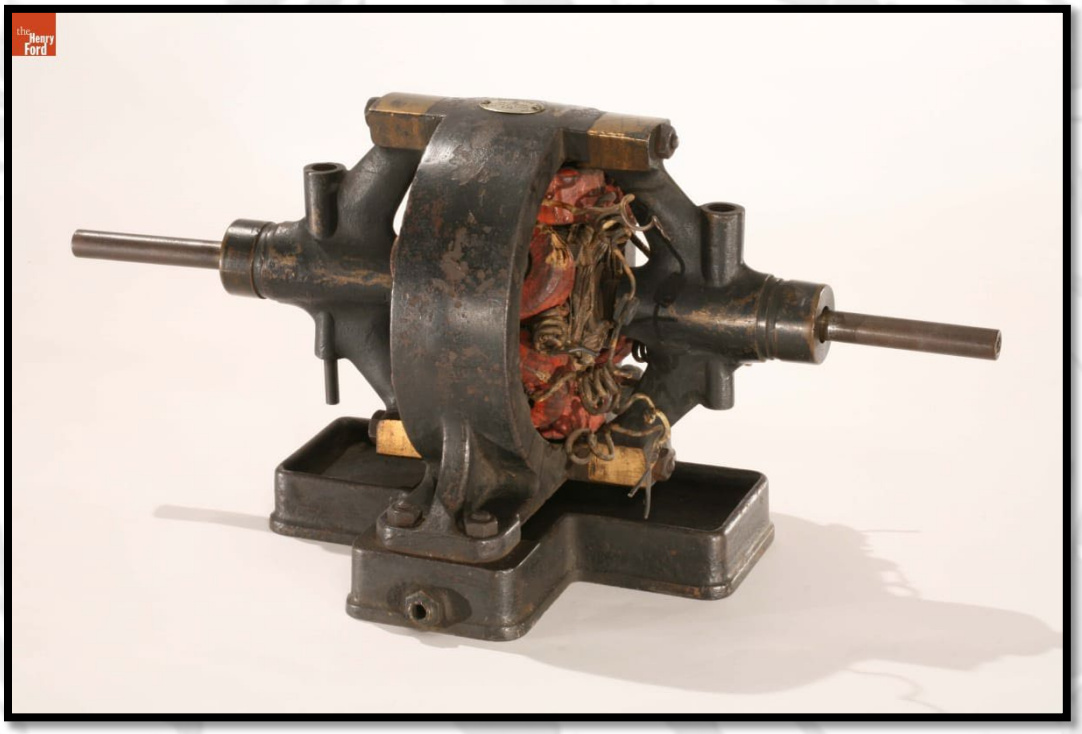
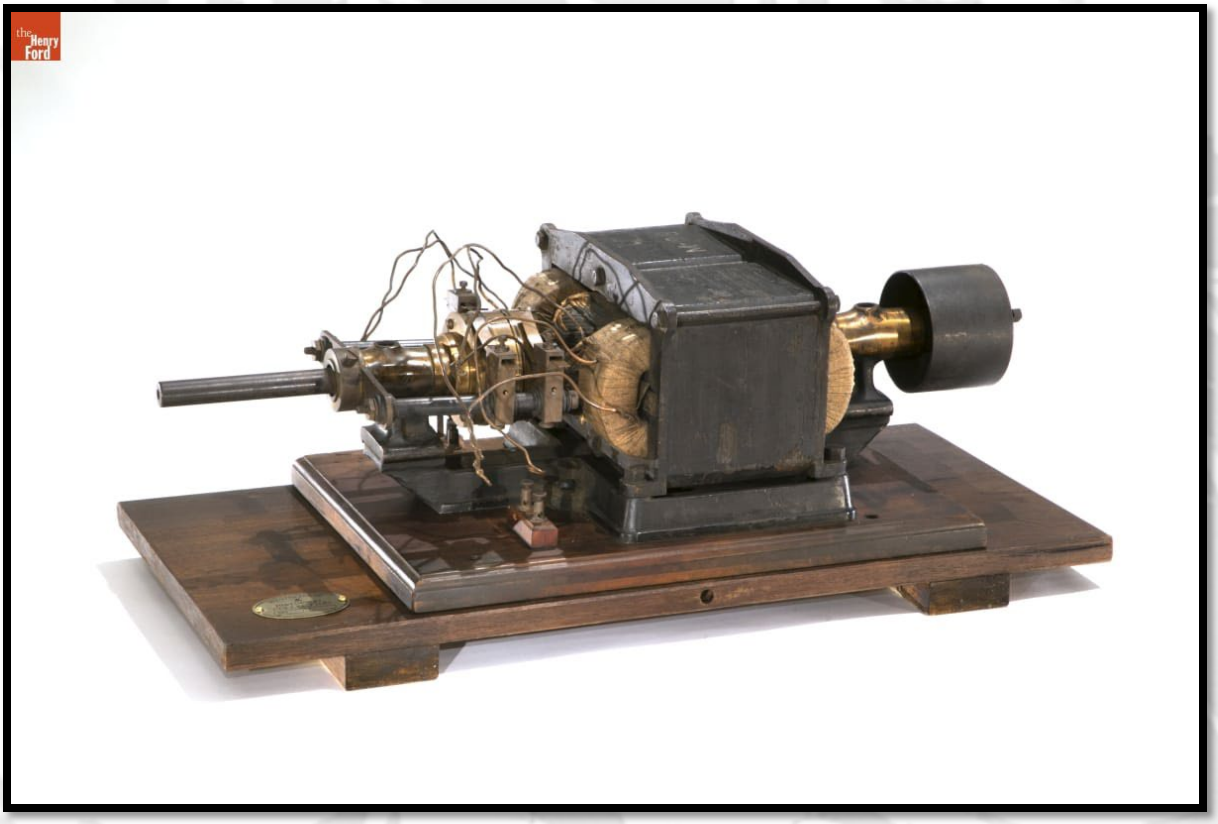
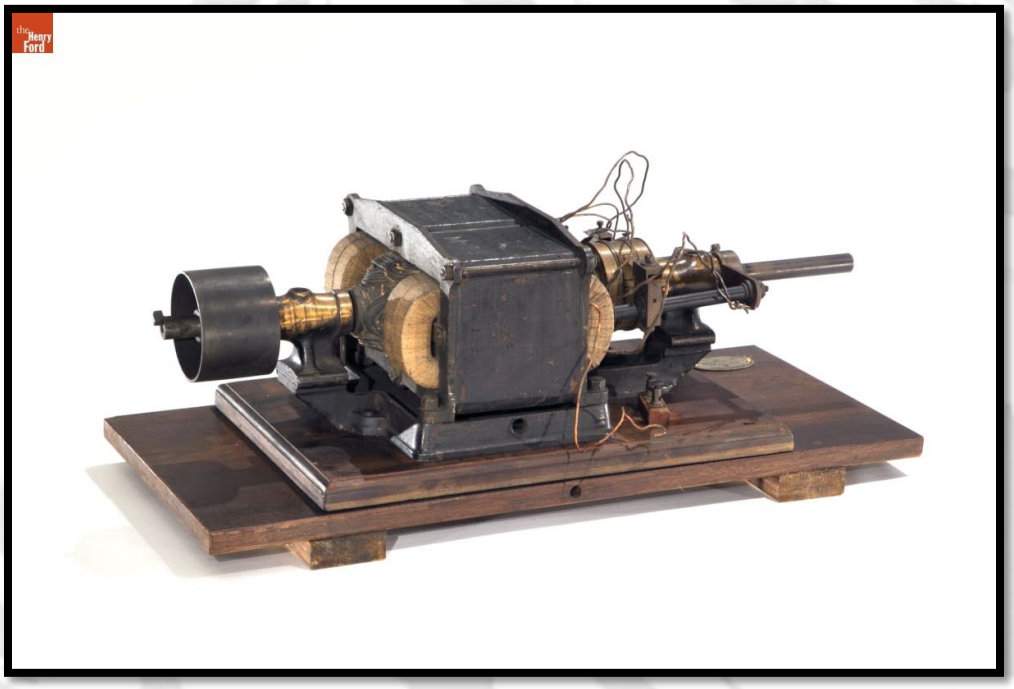


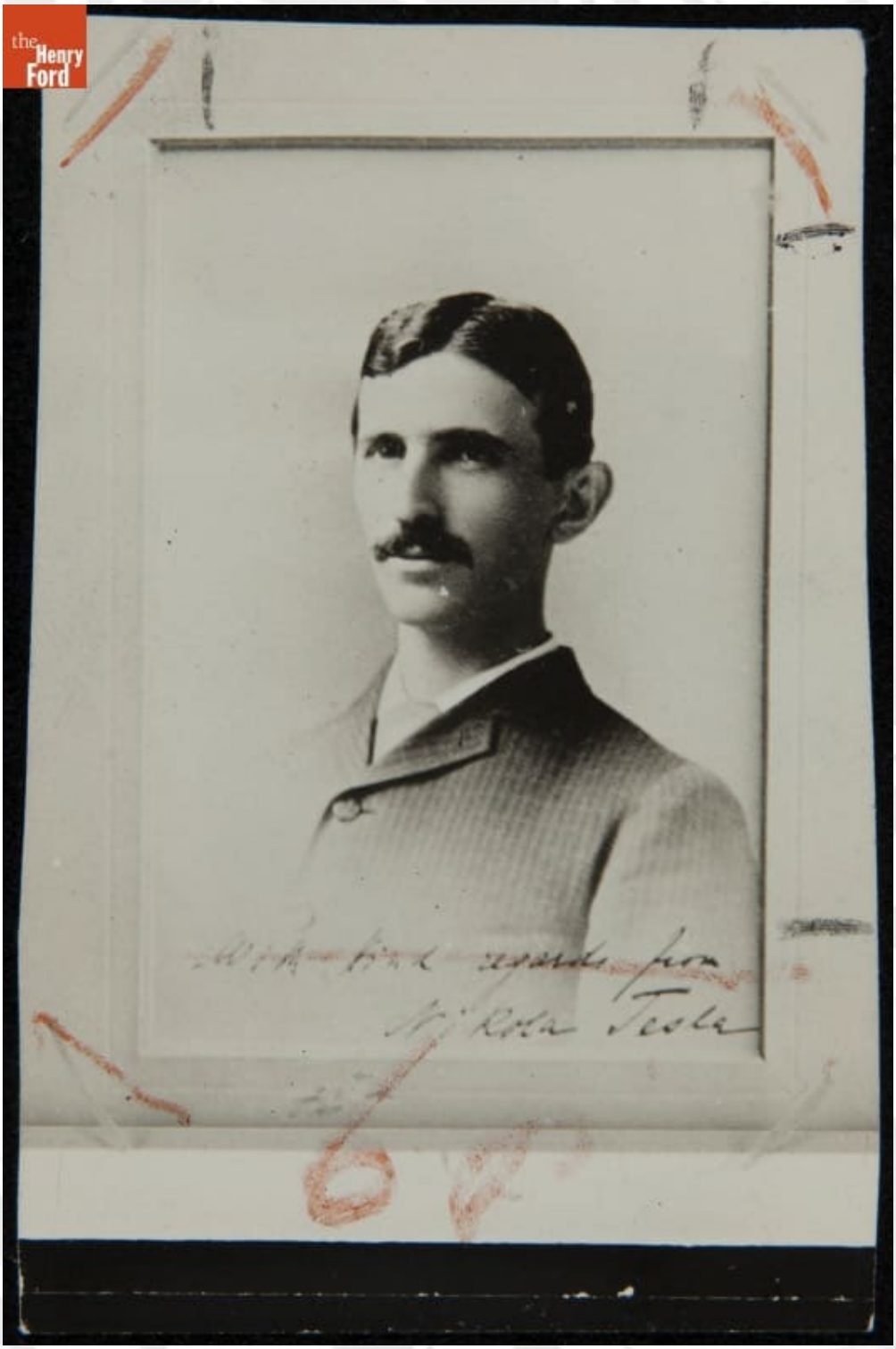


Laboratory Model of Tesla Motor, circa 1895, Henry Ford Museum

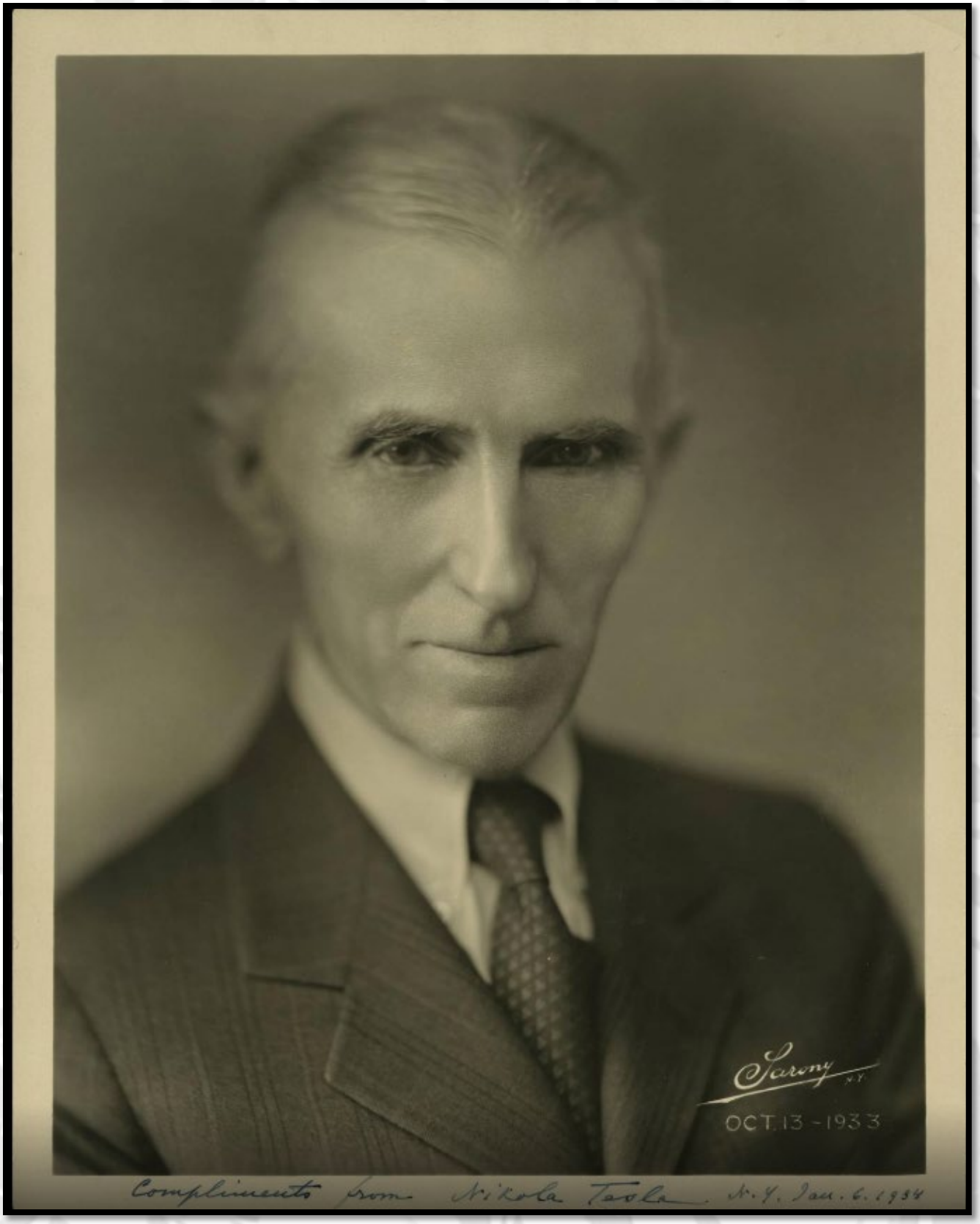




Laboratory Model of Tesla Motor, circa 1889, Henry Ford Museum



Nikola Tesla, Henry Ford Museum



Nikola Tesla 13. Oct. 1933, Henry Ford Museum

Hotel New Yorker

New York December 17. 1934.

G. S. Viereck Esq.
627 West 113 Street, N.Y.

Dear Viereck:

My capacities are limited and sometimes it happens that I am baffled in my efforts to solve the problem confronting me. It then becomes a question of life and death for the urge to find a solution is so great that I can not overcome it no matter how hard I may try. Irresistibly, I am driven to extreme concentration at the peril of a blood clot or atrophy in the brain. The most

difficult part of the task is to drive out of the mind the old images which are like corks on the water bobbing up after each submersion. But after days, weeks or months of desperate cerebration I finally succeed in filling my head chuckfull with the new subject excluding everything else and when I reach that state I am not far from the goal. My ideas are always rational because I am an exceptionally accurate instrument of reception, in other words, a seer. But be this true or not I am always mighty glad when I get through for there can be no doubt that such a surtax of the brain is fraught with great danger to life.

Let me tell you of one remarkable case

of this kind which may interest you as a psychologist. Years ago, after evolving my system of wireless transmission of energy, I came to the conclusion that to put it on a sound engineering foundation I had to unravel the electrical mysteries of the earth. The task seemed almost superhuman, but I had the boldness of ignorance to undertake it and passed several months in most intense concentration eventually gaining a clear insight when I was at the point of collapse. On my slow return to the normal state of mind I experienced an exquisitely painful longing after something undefinable. During the day I worked as usual and this feeling, though it persisted, was much less pronounced,

but when I retired the night, with its monstrous amplifications, made the suffering very acute until it dawned upon me that my torture was due to a consuming desire to see my mother. Thoughts of her led me to review my past life beginning with the earliest impressions of my childhood and I was dismayed to find that I could not recall clearly even her features except in one scene. It was a dismal night with rain falling in torrents. My brother, a youth of eighteen and intellectual giant, had died. My mother came to my room, took me in her arms and whispered, almost inaudibly: "Come and kiss Daniel." I pressed my mouth against the icecold lips of my brother knowing only

67.64.2 A

that something dreadful had happened. My mother put me again to bed and lingering a little said with tears streaming: "God gave me one at midnight and at midnight he took away the other one". This remembrance was like an oasis in the wilderness kept alive by some strange prank of the brain in the midst of oblivion. My recollections came slowly gaining in clearness and after weeks of thinking the images appeared sharply defined and in a fullness of light which astonished me. Uncovering more and more of my past life I came to review my American experiences. In the meantime my craving

had become almost unbearable and every night my pillows were wet from tears. Unable to stand it longer I resolved to quit work and go home. This I did and after a multitude of experiences I found myself in Paris whither I had fled from London to escape the fuss raised about me in England. I had to get off some final proofs for one of my lectures before leaving and while doing this a messenger handed me a telegram from my uncle which read: "Your mother is dying hurry if you want to find her alive". I rushed for the train and after a three days journey over the mountains at breakneck speed I reached, bruised and exhausted, my mothers bedside.

She was in the agonies of death but the joy of seeing me worked the miracle of a temporary recovery. I never left her until my own condition became such that I was taken to another building in the neighborhood for a short rest. When I was alone in my bed I meditated on what might happen if my mother died. Would there be a disturbance in the ether? If so could I detect it? My senses were acute to an incredible degree. I could hear the ticking of a watch at a distance of fifty feet. A fly alighting on a table in the center of the room produced in my ear a thud like that of a pile-driver and I could hear plainly the clatter of his feet. I was a trained scientific

observer well qualified to make an undistorted record of what I perceived. If such a transmission of effect was possible the best conditions existed for establishing the fact. Mindful of the enormous scientific importance of such a discovery I struggled desperately against sleep and, with my senses sharpened by the darkness and stillness of the night, I watched intently. Five or six hours, seeming like an eternity, passed without a sign and then I gave out falling into a sleep or swoon. When I came to an indescribably sweet music filled my ears and I saw a floating white cloud in the center of which my mother was reclining looking

67.64.2B

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and, sure enough, a maid came running
who brought the mournful message.
This knowledge gave me a terrifice
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that I was - in New York! My mother

had died years before but I had forgotten it! How could this happen I asked myself horrified and bitterness, pain and shame overwhelmed me. My sufferings had been real though the events were but imaginary reflections of previous occurrences. What I experienced was not the awakening from a dream but the restoration of a particular department of my consciousness.

At the time the events related actually took place I was in a hysterical state and inclined to believe that there was really a psychic manifestation, a post mortem message from my mother, but I soon dismissed this idea as sheer nonsense. I am proving constantly, by every thought and act of mine,

that I am nothing more than an automaton responding to external stimuli and passing through an infinitude of different existences from the cradle to the grave.

The explanation of these mental phenomena is, after all, very simple. Through long concentration on a special subject certain fibers in my brain, for want of blood-supply and exercise, were benumbed and could no longer respond properly to outside influences. With the diversion of my thoughts they were gradually vivified and finally brought back to their normal condition. The desire to see my mother was due to my examination of some artistic fabrics woven by herself which had awakened in me tender memories shortly before I began to concentrate. I heard the music because my

mother died on Easterday just when a choir was singing in a church not far from me. But to locate the external impression which caused the apparition I had much trouble until I remembered that, on my return from Europe, I passed through Munich and saw there, among others, a painting of Arnold Böcklin interpreting one of the seasons and showing a group of allegorical figures on a cloud. So wonderfully skillful was the artist in this creation that the cloud seemed positively to float in the air as if supported by some invisible means. This made a deep impression on me. The practical lesson of all this is to beware of concentration and be content with mediocre achievement.

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With best regards Sincerely yours N. Tesla

67.64.2C

Hotel New Yorker
New York December 17, 1934

G. S. Viereck Esq.
627 West 113 Street, N. Y.

Dear Viereck:

My capacities are limited and sometimes it happens that I am baffled in my efforts to solve the problems confronting me. It then becomes a question of life and death for the urge to find a solution is so great that I can not overcome it no matter how hard I may try. Irresistibly, I am driven to extreme concentration at the peril of a blood clot or atrophy in the brain. The most difficult part of the task is to drive out of the mind the old images which are like corks on the water bobbing up after each submersion. But after days, weeks or months of desperate cerebration I finally succeed in filling my head chuckfull with the main subject excluding everything else and when I reach that state I am not far from the goal. My ideas are always rational because I am an exceptionally accurate instrument of reception, in other words, a seer. But be this true or not I am always mighty glad when I get through for there can be no doubt that such a surtax of the brain is fraught with great danger to life.

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With best regards

Sincerely yours

N. Tesla

(all spelling as author wrote)

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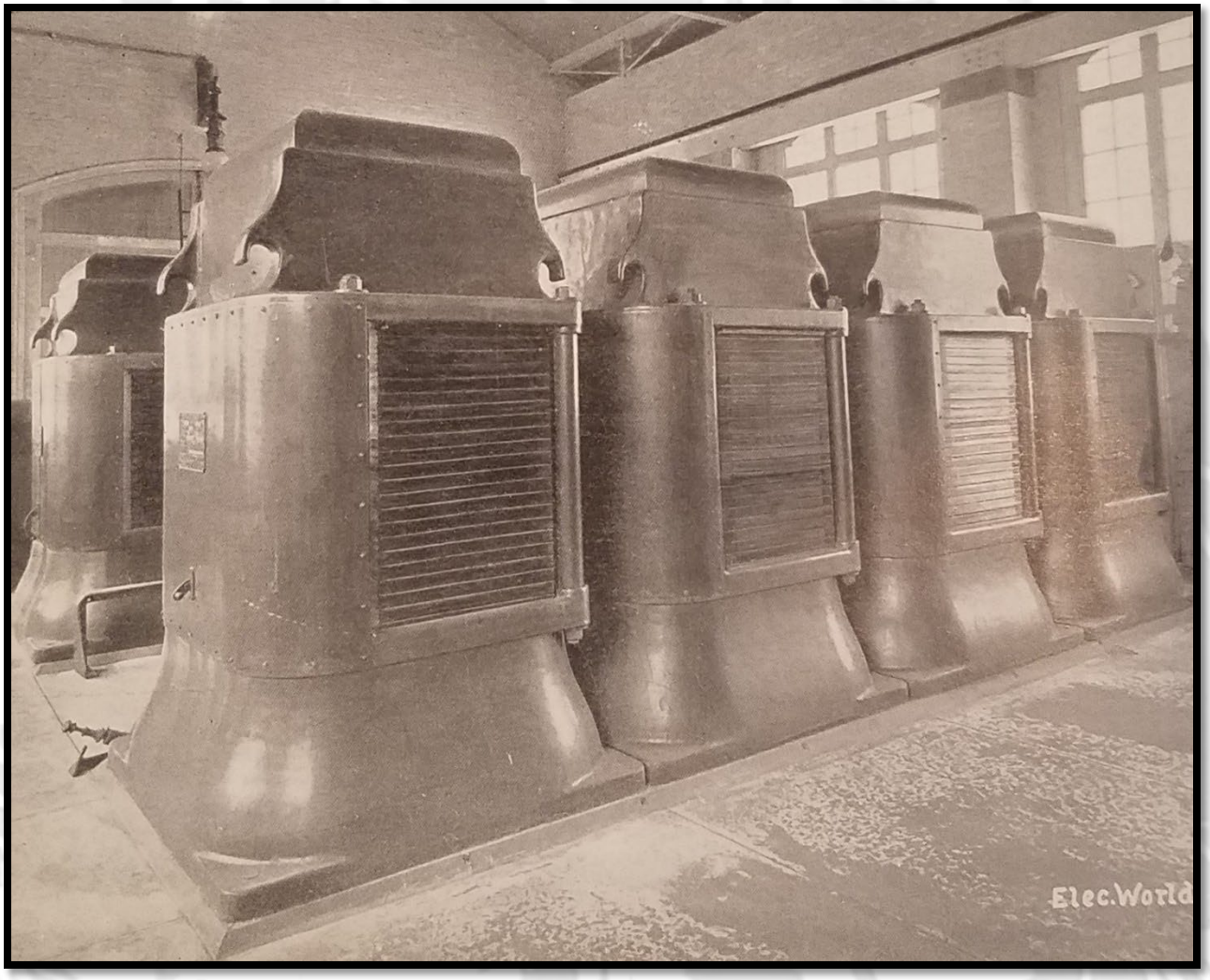
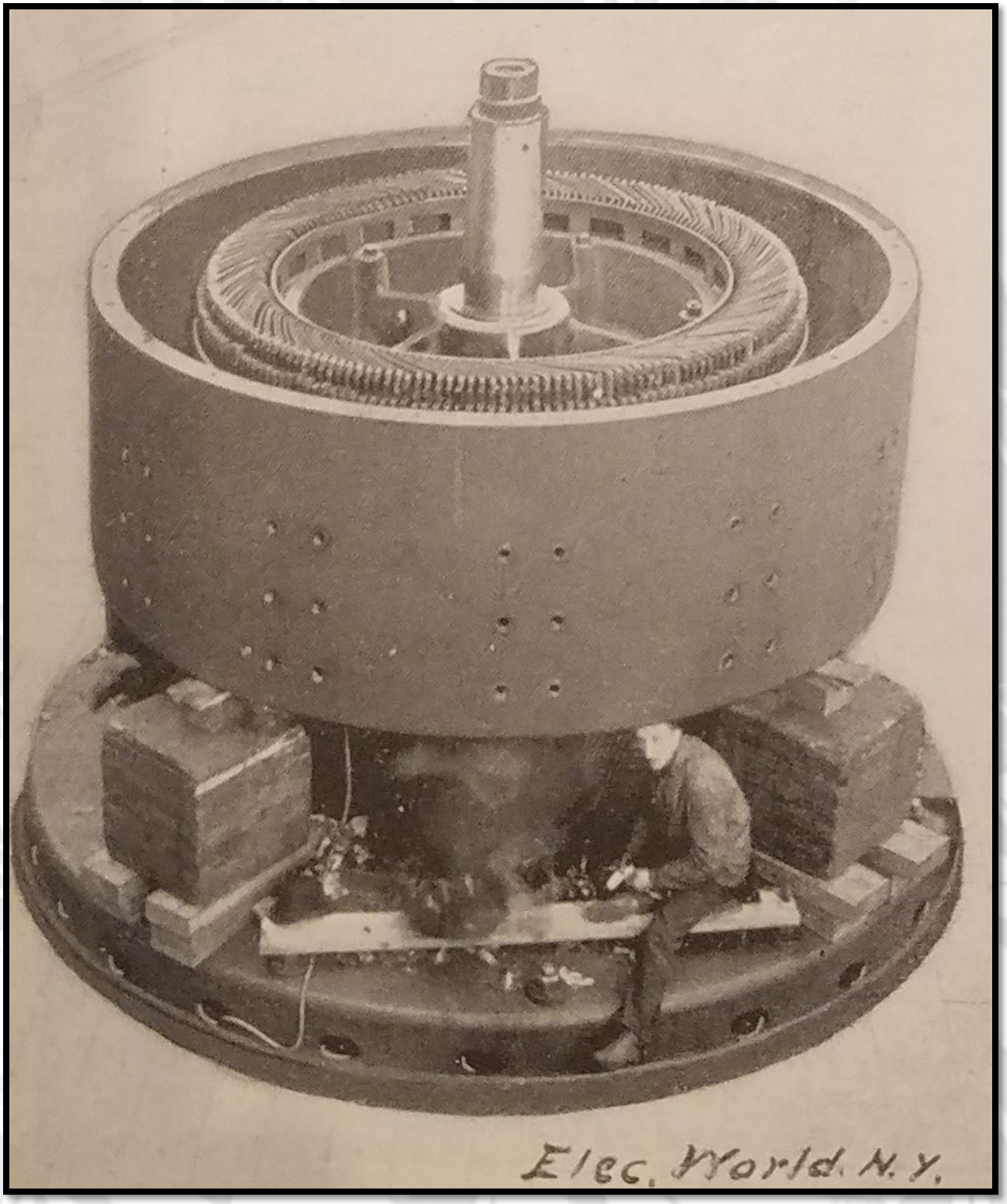
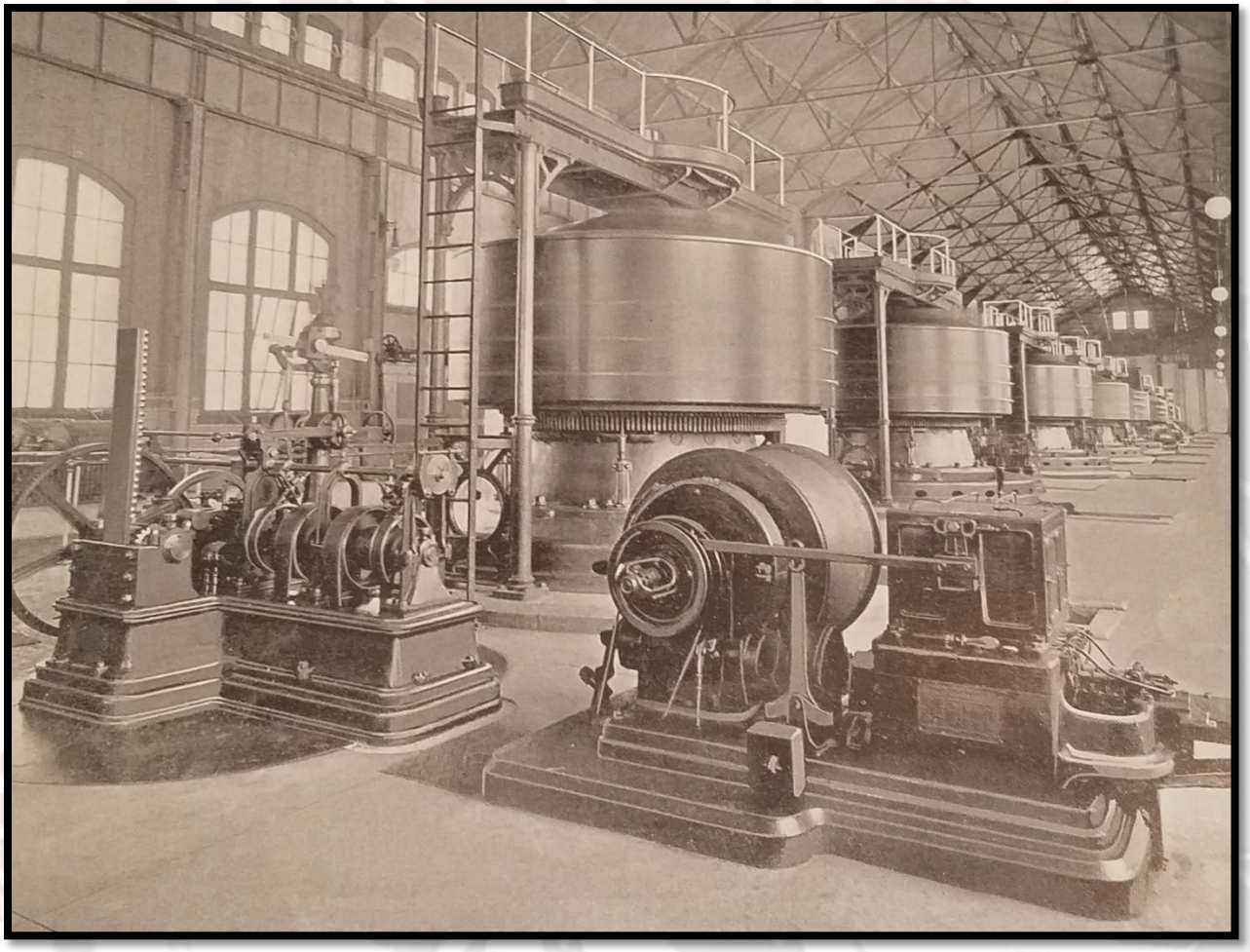
An interior view of the Westinghouse alternators at Niagara Falls.
The Electrical World, Volume XXXIII No 1.



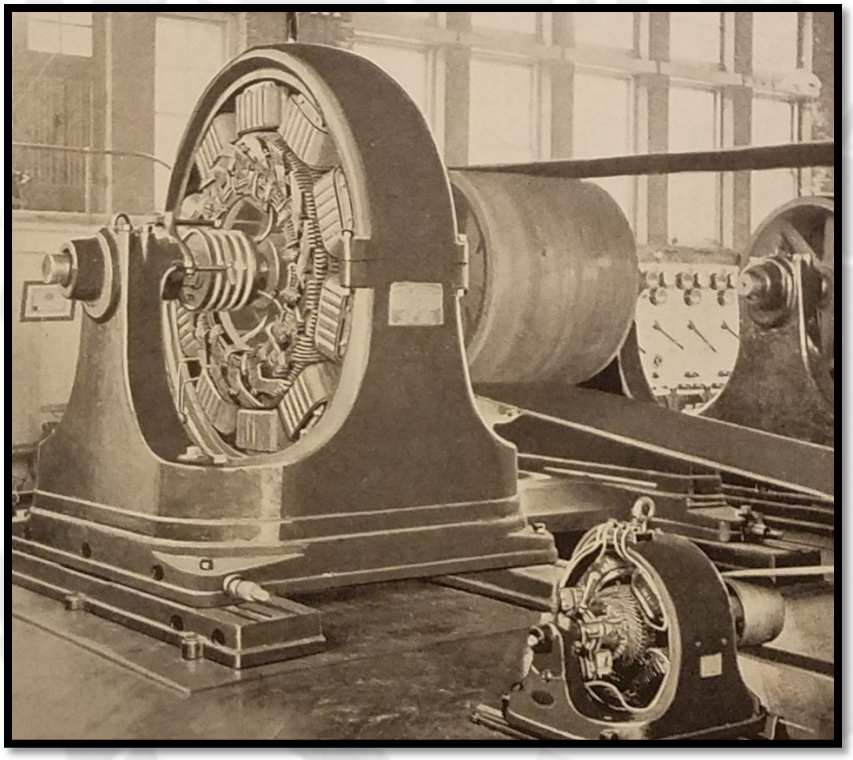
935 KW transformers, 4 of which handle the loads of the 5000 HP Generators at Niagara Falls.
The Electrical World, Volume XXXIII No 1.

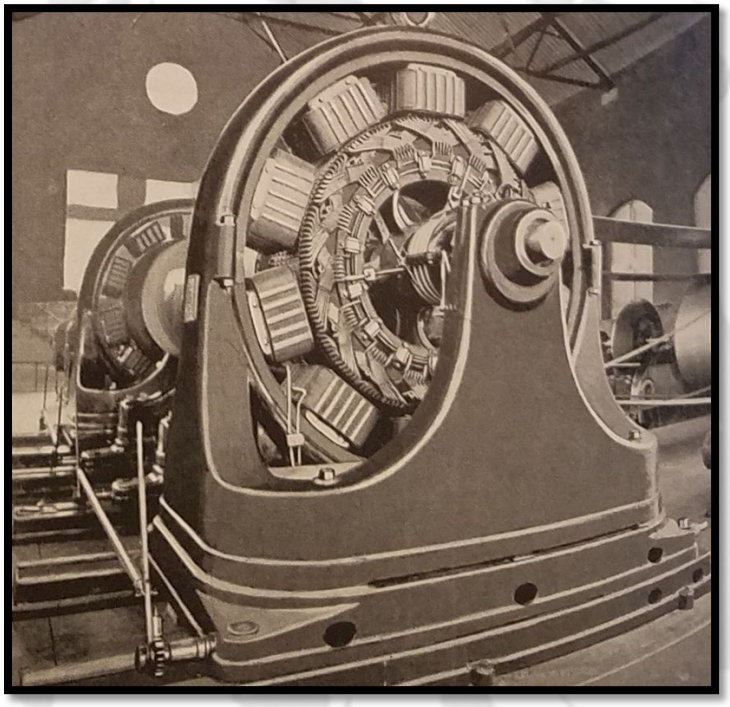


A view of one of Niagara Fall's generators being built in East Pittsburgh.
The Electrical World, Volume XXXIII No 1.

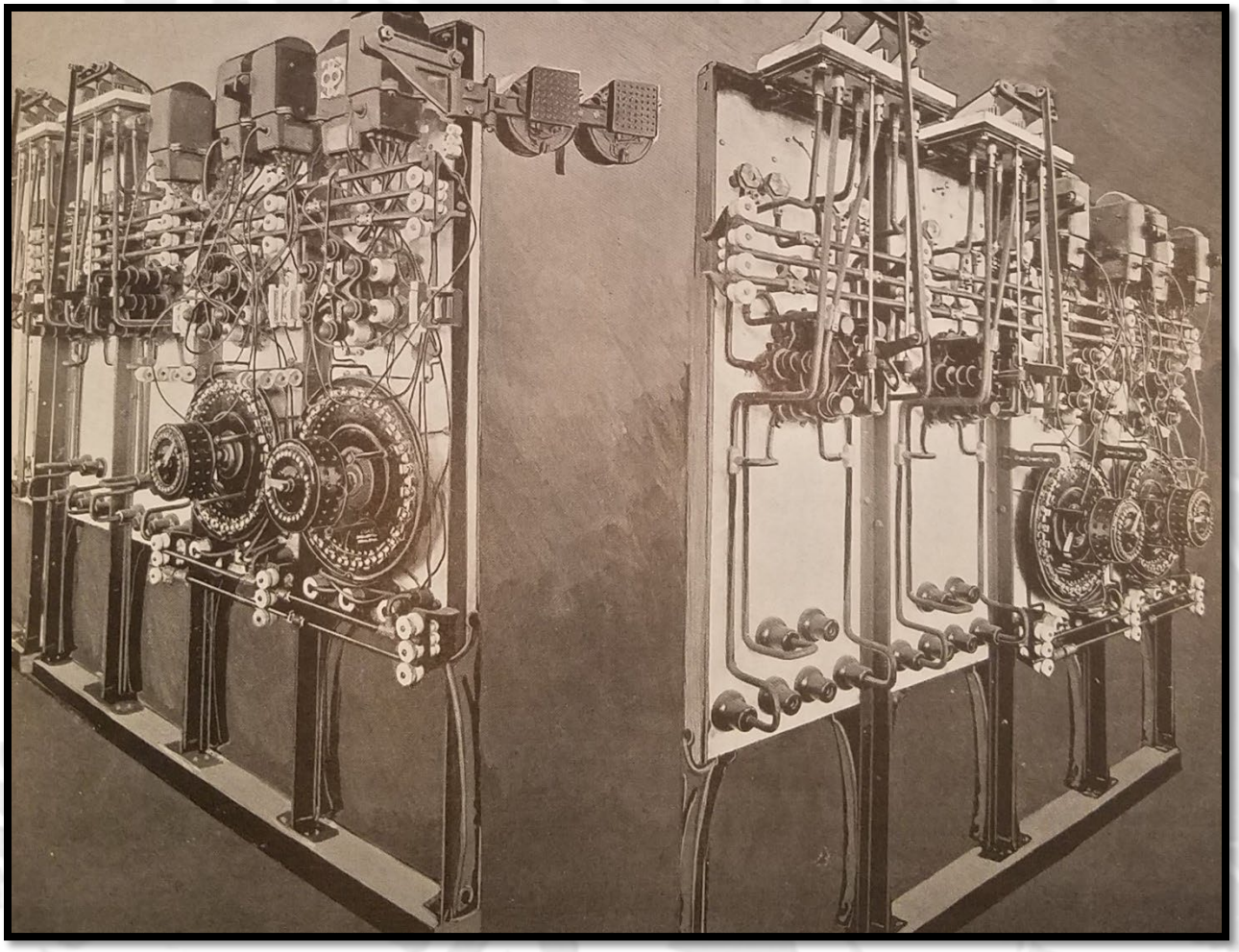


View of the machine room at Niagara Falls.
The Electrical World, Volume XXXIII No 1.





Views of several alternators at Niagara Falls.
The Electrical World, Volume XXXIII No 1.



View of one of the switchboards and regulating apparatus at Niagara Falls.
The Electrical World, Volume XXXIII No 1.

Niagara Falls

NIAGARA is the first spectacle of Earth. Here beauty of color and majestic outlines are united as nowhere else with ceaseless, overwhelming force. The Yosemite, the snow-capped Alps, the glories of Venice, the wonders of cave or mountain or sea possess one or the other, but never both. Niagara is at once a magnificent picture, a work of art, and at the same time an exhibition of giant power — a power that is perpetual, that knows no lapses, no holiday, no rest, that goes on and on and on forever. Nothing gives one such a glimpse of eternity — such an idea of the endless, of infinity — as this.

The best impression of Niagara is the result of memory. Few people realize the philosophy, the religion of this — the grandest sermon ever preached — until after the first blush of acquaintance is over.

Nor again do they gain the fullest appreciation of the mighty cataract, until it has been seen under winter's frown, as well as summer's smile; by sunrise and by moonlight, in calm and storm. Ever and anon she presents new phases of interest. From every different vantage ground, a fresh sensation of delight is derived. But whatever the sight there is always the sound too — the constant, persistent, monotonous, awful roar, which says in unmistakable voice, "I am the handiwork of God. From Him do I derive this mighty power, and unto Him must I return account."

• • • •

PUBLISHED EXCLUSIVELY FOR

S. H. KNOX & COMPANY, - NIAGARA FALLS, N. Y.

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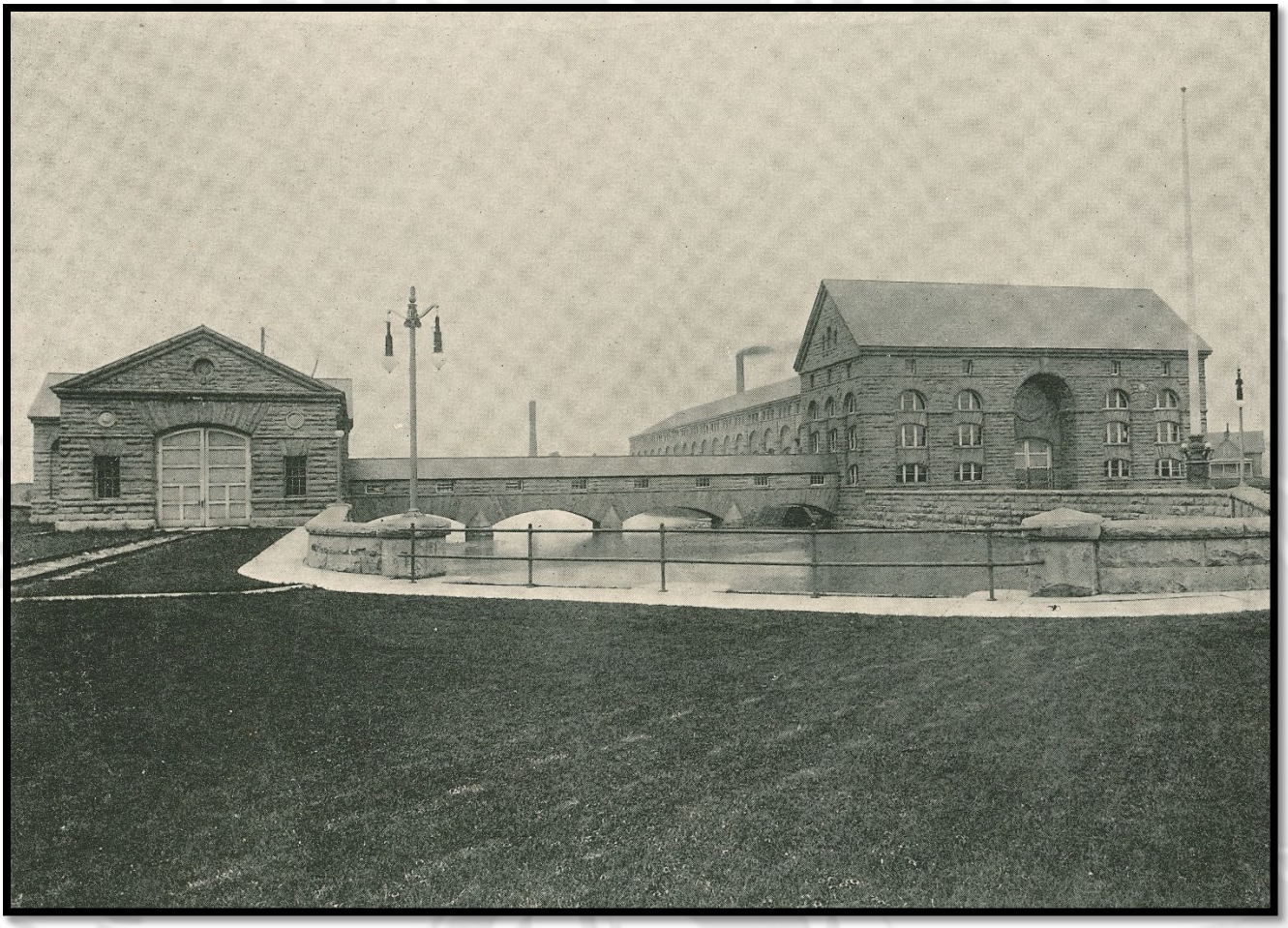
L. H. NELSON CO., Portland, Me.

All public buildings shown herein were designed by
E. E. Joralemon, Architect, Niagara Falls, N. Y.

Niagara Falls, L. H. Nelson Co., 1904, Published for S. H. Knox & Company

General view of Niagara Falls showing the American Fall to the left – the Canadian or Horseshoe Fall on the right, also the inclined plane which carries people down the steep side of the gorge to the steamboat landing.
Niagara Falls, L. H. Nelson Co., 1904, Published for S. H. Knox & Company

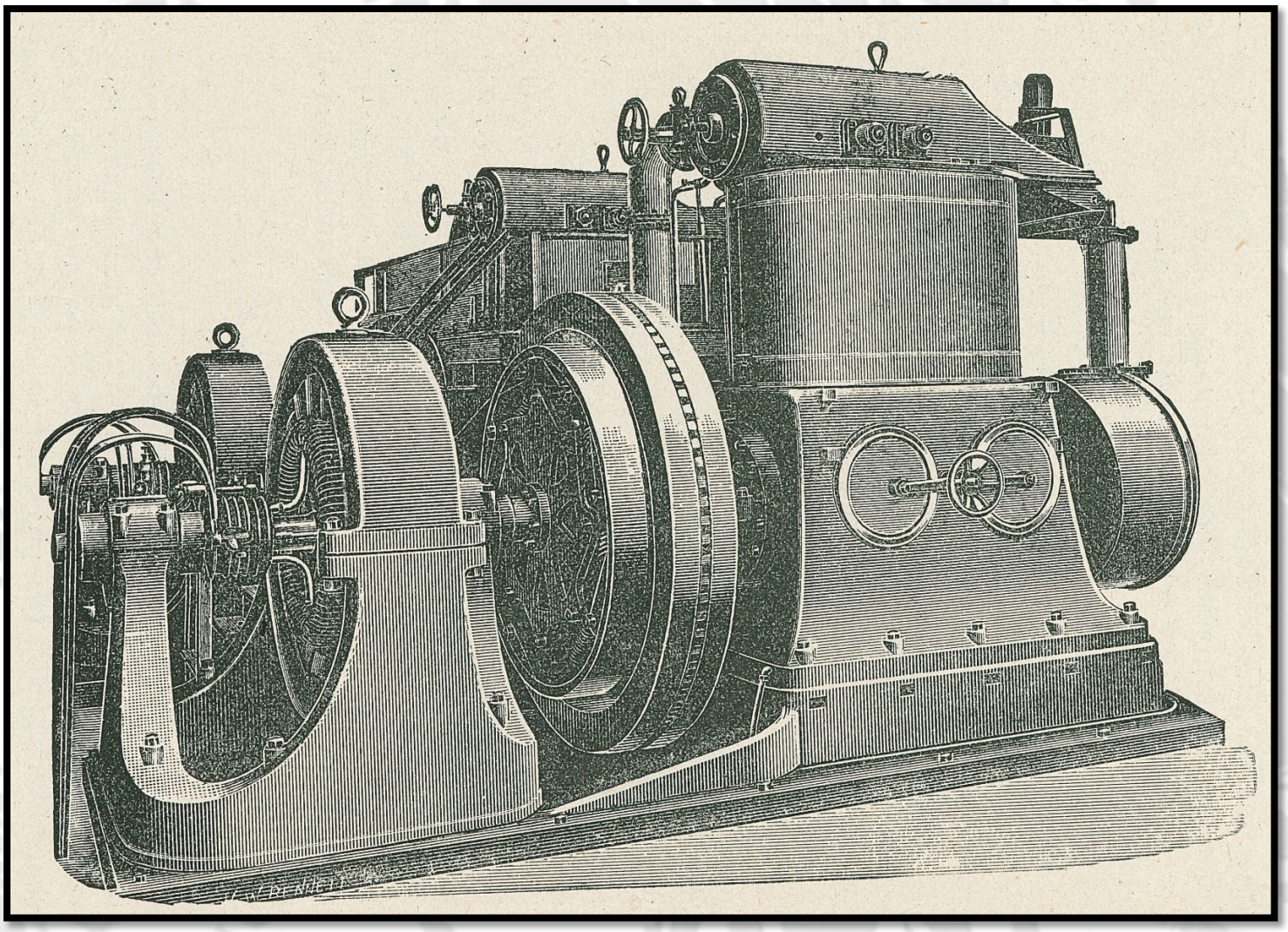


Niagara Falls Power Company's Plant – where energy for which centuries has been going to waste has now been harnessed for the service of mankind. Niagara Falls, L. H. Nelson Co., 1904, Published for S. H. Knox & Company

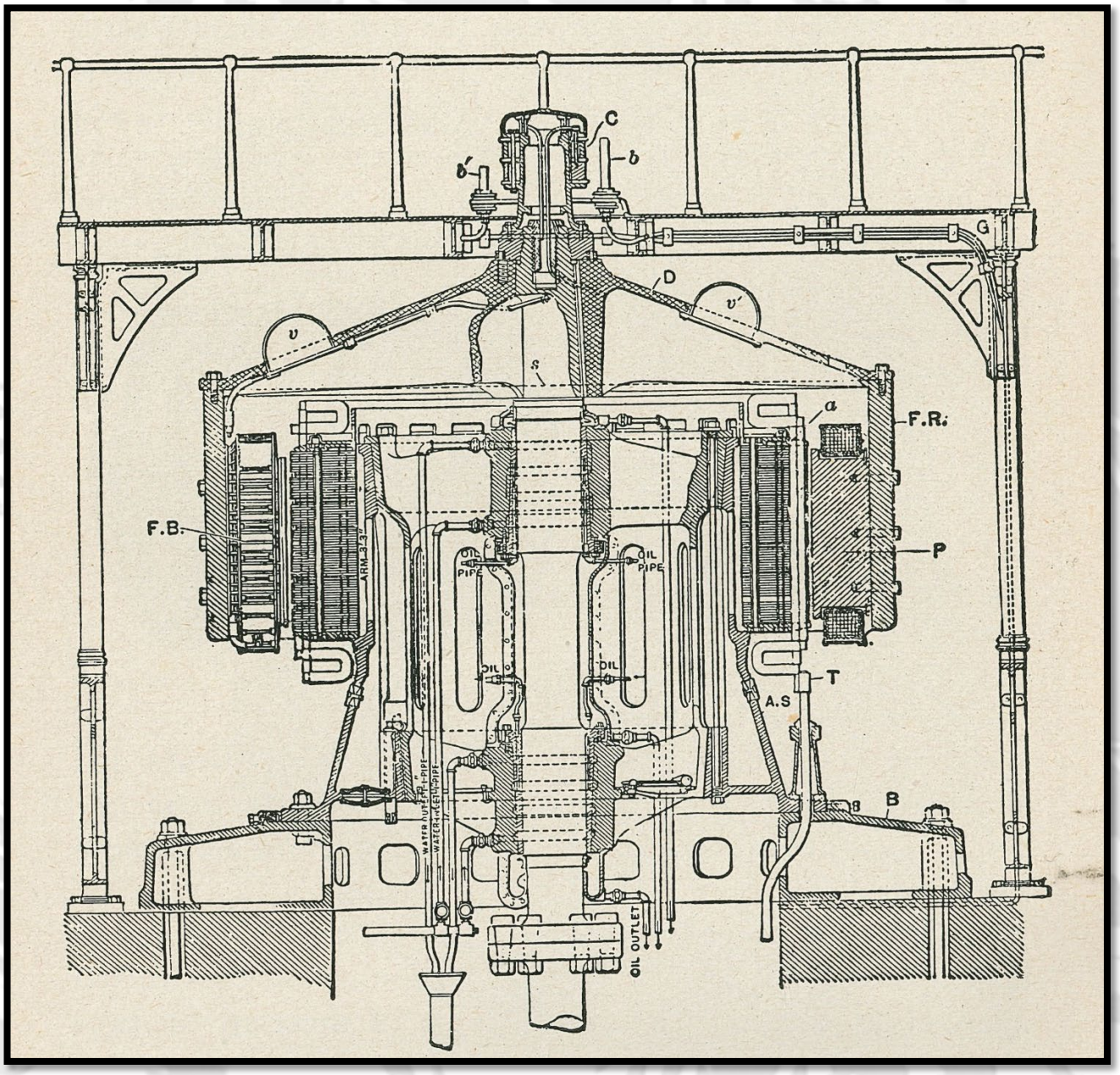
Interior view of power house showing the gigantic generators whose power is utilized by numerous railroads and manufacturing plants. Niagara Falls, L. H. Nelson Co., 1904, Published for S. H. Knox & Company

The White Man's Fancy – This painting by James Francis Brown, in the Cataract House, Niagara Falls, shows a beautiful maiden whose beckoning figure lures one to follow her to her fascinating but dangerous home "amidst the mist."
Niagara Falls, L. H. Nelson Co., 1904, Published for S. H. Knox & Company

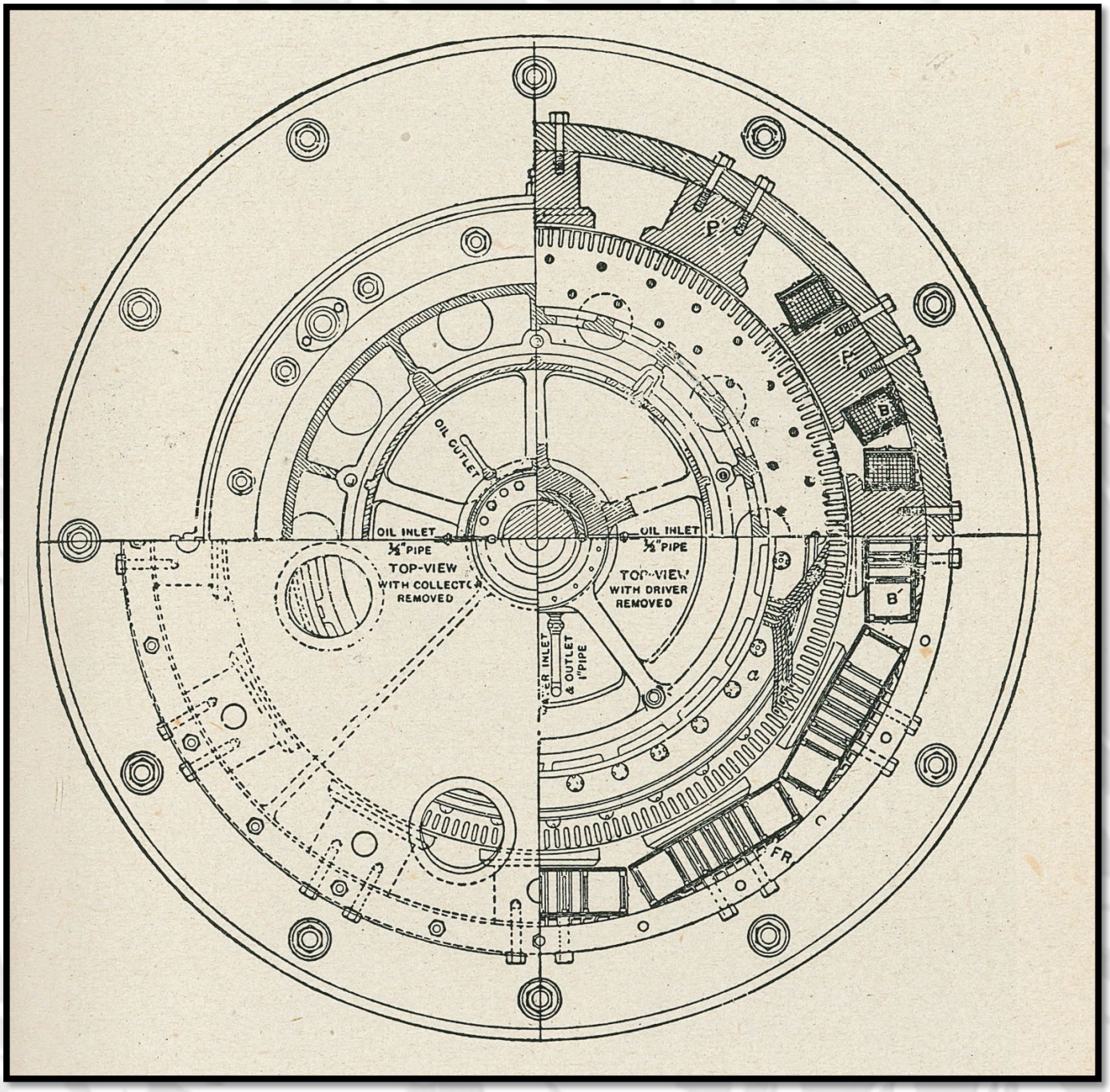
The Red Man's Fact – This painting in the Cataract House represents a legend of the Indians. They were accustomed to make an offering each year of the fairest maiden in their tribe to the Deity supposed to be embodied in the Raging Water. This year the daughter of the chief has been chosen, and her father may be seen paddling after her in his canoe. Tradition says he followed her into the foaming waters and his loss caused the abandonment of the custom. Painted by James Francis Brown. Niagara Falls, L. H. Nelson Co., 1904, Published for S. H. Knox & Company



Tesla - Westinghouse Engine and 500 Horse-Power Generator used to provide power at the Westinghouse Electric Company. Silvanus P. Thomson, “Polyphase Electric Currents and Alternate-Current Motors”, 1900 Second Edition

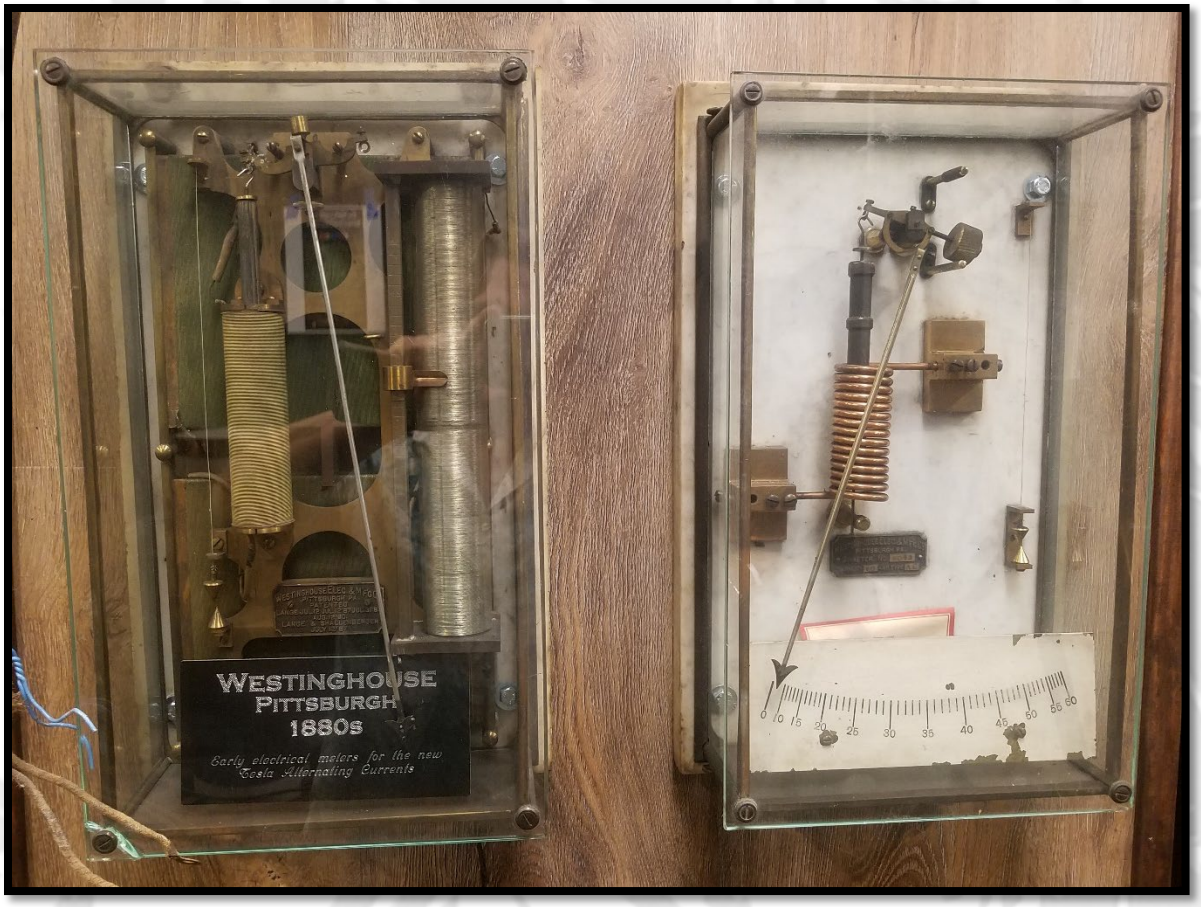


Sectional Elevation of the 5000 H. P. Two-Phase Generators at Niagara Falls
Silvanus P. Thomson, “Polyphase Electric Currents and Alternate-Current Motors”, 1900 Second Edition

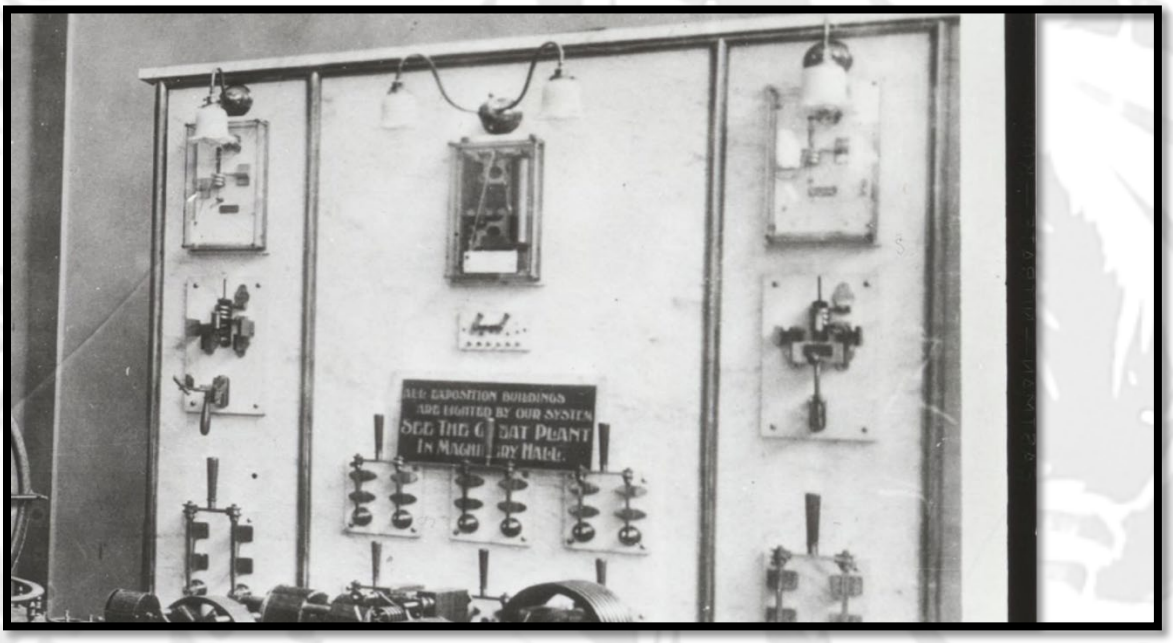


Plan of the 5000 H. P. Two-Phase Generators at Niagara Falls
Silvanus P. Thomson, “Polyphase Electric Currents and Alternate-Current Motors”, 1900 Second Edition

Westinghouse Stopper Lamp from 1893 Columbia Exposition World's Fair.
Donation to the author's collection from Frank Jones.



Original Westinghouse Meters manufactured the same period as those exhibited at the 1893 Chicago World's Fair. From the author's collection.



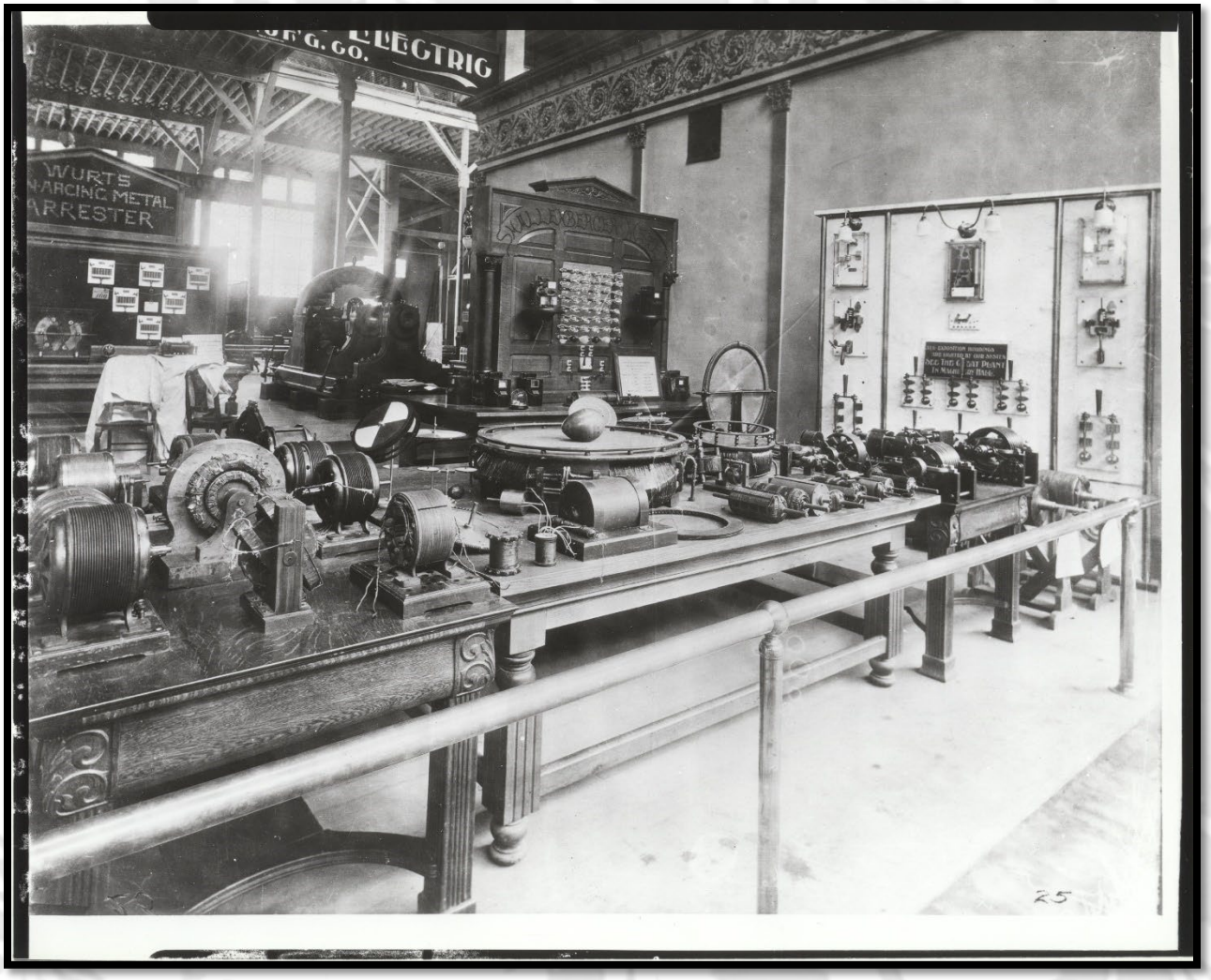
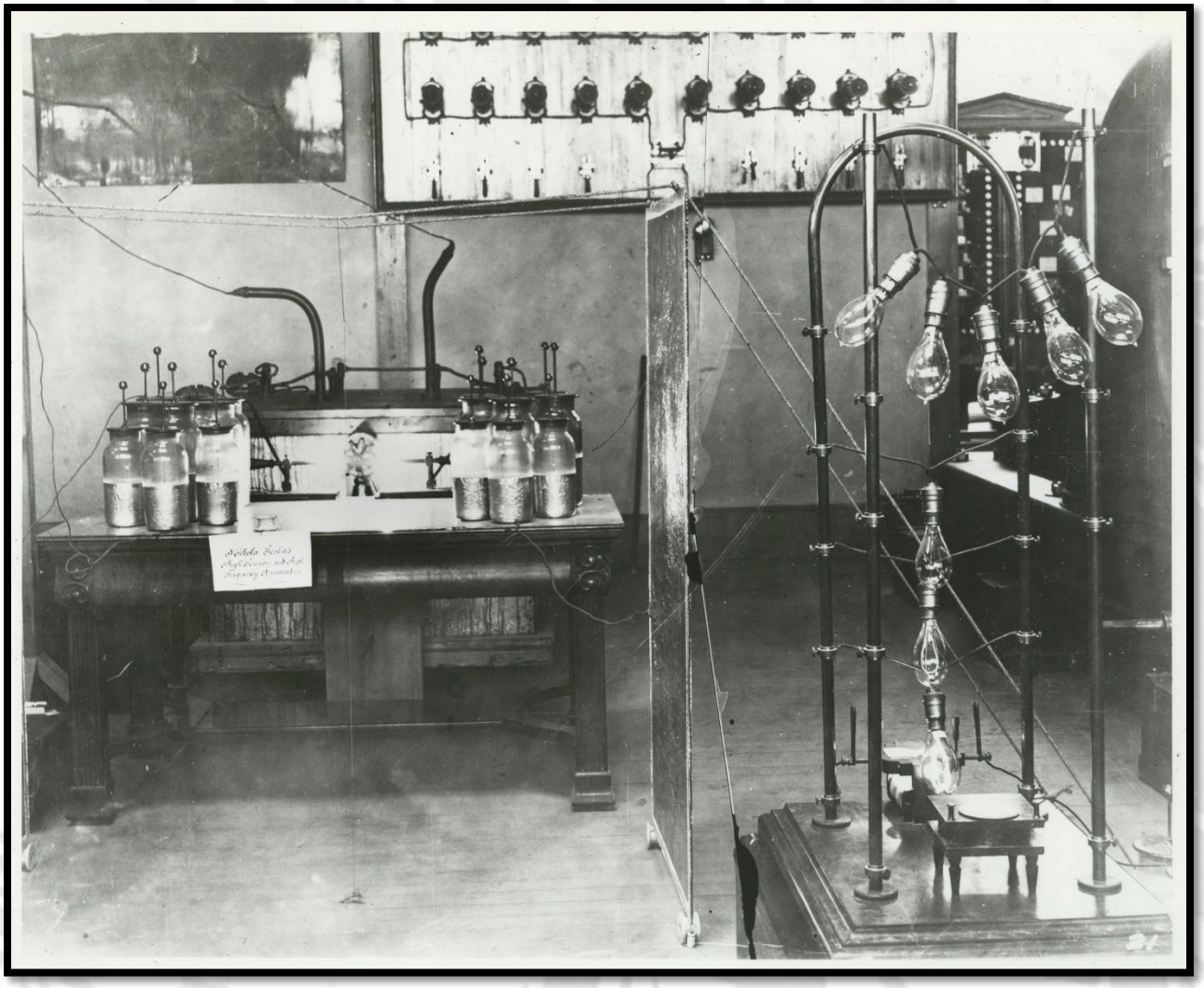


Exhibit of Tesla's early inventions from 1893 Columbia Exposition World's Fair.
George Westinghouse Museum Collection, c.1864-2007, MSS 920,
Detre Library and Archives, Senator John Heinz History Center



Original high frequency coil seen here in operation demonstrated at the 1893 Columbia Exposition World's Fair. This was used to demonstrate wireless lighting in a strong electrical field generated between two large insulated condenser plates. The display on the right is an impedance circuit used to show demonstrations of powering standard incandescent lamps from high frequency currents. The experiment is novel because for low frequencies the stout cooper loop would represent a short-circuit, but by energizing it with high frequency oscillations nodes can be found along the loop to light the carbon filaments to any desired brilliancy.

George Westinghouse Museum Collection, c.1864-2007, MSS 920,
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REPRINTED FROM
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NEW YORK, OCTOBER 19, 1892.

A Visit to the Westinghouse Electric Works at Pittsburgh.

by Jos. Wetzler.

The Westinghouse Electric and Manufacturing Co. Pittsburgh, Pa.

A Visit to the Westinghouse Electric Works at Pittsburgh.

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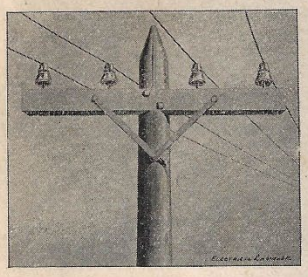
Jos Wetzler.

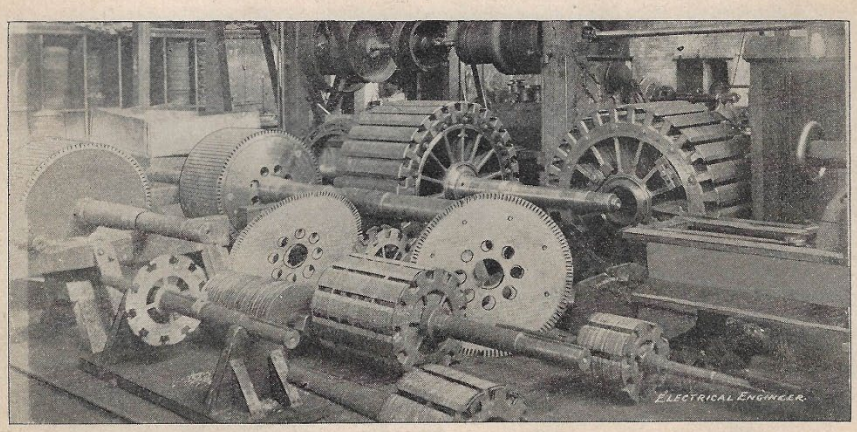
I.



THE organization of the Westinghouse Electric Company in 1886, laid the foundation for an industry of which until that time very little was known either in the city of Pittsburgh or, for that matter, even in the United States. Until the Westinghouse Company entered the field of electrical manufacture, the direct-current system of incandescent electric lighting was the only method generally practiced. Owing to the many inherent disadvantages and limitations of that system for covering large areas, the introduction of incandescent lights had been very slow, and it may be truly stated that it is in no small measure due to the energetic efforts of the Westinghouse Company and the wonderful success of their alternating system that America is now the great electric country of the world. Previous to the introduction of the Westinghouse electric lighting system, incandescent plants were few and far between.

It was a very costly undertaking to establish a large central station and equip it with direct current apparatus having sufficient capacity and range to cover a city or town. Hence the incandescent light was, until 1886, only used by rich corporations, or in municipalities where thickly-populated districts warranted the establishment of a plant. Immediately upon the advent of the alternating system, electric lighting was brought within the reach of everybody in small and large towns, due to the fact that the current can by that system be carried a long distance without the expense of the heavier and more expensive copper wire needed for the direct current.

A demand was therefore at once created for the establishment of central station electric lighting plants such as had not been known before. Thus it came about that within four years the Westinghouse Company installed its apparatus in nearly four hundred cities and towns all over the world, and at this writing there are every night more than a million incandescent lamps burning throughout the world which obtain their current from Westinghouse alternating current generators—apparatus that has all been manufactured in the city of Pittsburgh. It can be readily seen, therefore, that through the Westinghouse Electric Company an influence has been exercised over one of the most important industries in this country, the results of which are of the utmost benefit and value to the whole industry.

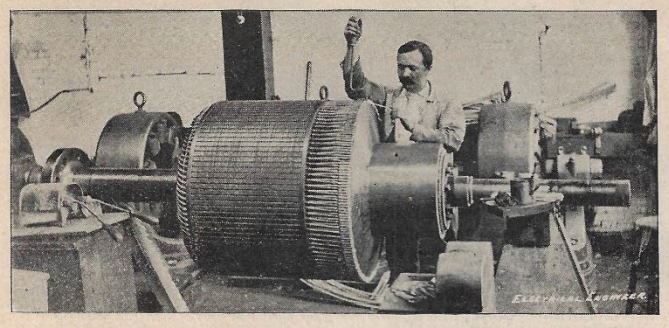


ALTERNATING AND DIRECT CURRENT ARMATURE CORES—WESTINGHOUSE WORKS, PITTSBURGH.

As has already been stated, this company was organized in 1886. It grew out of a department of the Union Switch and Signal Company. The new corporation was capitalized with the sum of $5,000,000 and started to work. The company installed its first central station plant in Buffalo, N. Y., and for some time this was the focus of interest for the electrical public of that period. The successful operation of the Buffalo plant established the fact that an electrical system for the distribution of incandescent lighting had been put upon the market which had no equal for central station plants, intended to serve large areas.

Another feature of the Westinghouse system, and one which greatly enhanced its popularity, consisted in the excellence of the apparatus. Simplicity and durability of construction, with the highest efficiency, are made the paramount considerations in the manufacture of one and all of the apparatus of the Westinghouse Electric Company. The result has been that the reputation of the system soon grew

worldwide. Demands for its apparatus came, within the first year after the establishment of the company, from England, China, Japan, the West Indies and other foreign countries. One of the Westinghouse plants in England is situated in the heart of London and has a capacity of 50,000 incandescent lamps.



SOLDERING ARMATURE WIRES TO COMMUTATOR OF RAILWAY GENERATOR.

In 1888 the company made another great step in the further development of its system by the introduction of devices for measuring the electric current as consumed by the lamps. This device is the Shallenberger alternating current meter, the commercial advantages of which appealed at once to every central station manager. These meters are now utilized in measuring the current for nearly one million 16 c. p. incandescent lamps. Close upon the introduction of this meter followed the Westinghouse alternating current arc light system, in which a number of advantageous features had been developed, both in the current generator and in the lamp. The Tesla rotary phase motor was also taken up, and with it came in rapid succession the Westinghouse electric street railway system and the system for the long-distance transmission of power. In both these fields opportunities existed, which offered the greatest possibilities for a manufacturing company equipped with a producing capacity like that of the Westinghouse Company.

To give an approximate idea of the different apparatus the Westinghouse Electric and Manufacturing Company manufactures today, the following facts may prove helpful: The company manufactures alternating current apparatus for central station electric lighting plants from 500 to 10,000 16 c. p. light capacity; alternating current motors developing from $\frac{1}{8}$ h. p. to operate a fan, up to 500 h. p. for the operation of mining and mill machinery; direct current motors for the operation of electric street railways from 15 h. p. up to any capacity desired, and direct current power generators from 80 up to 1,000 h. p.

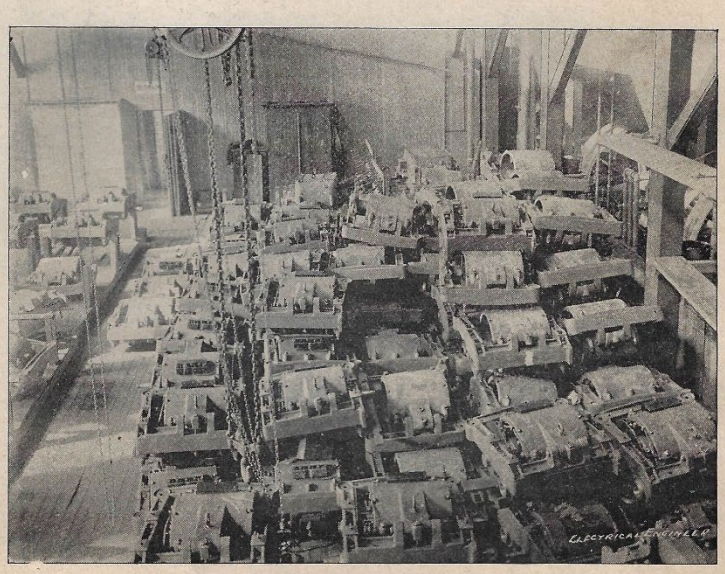
In addition to these machines, the company also makes all the apparatus used in the complete equipment of central station plants, the complete equipment for the installation of an electric street railway power plant and the complete equipment for the installation of an electric power plant for the operation of manufacturing establishments.

The Westinghouse Electric and Manufacturing Company owns a factory in New York City, and one in Newark, N. J. In the latter city the company manufactures direct current motors of all sizes and power; also direct current generators used for the operation of isolated plants, such as are installed in hotels, office buildings, apartment houses, theatres and small manufacturing establishments.

In addition to these exceptional manufacturing facilities, it owns and controls nearly one thousand important patents relating to all branches of the electrical industry.

II.

After this necessarily brief outline of the history of a company whose work is standard in both electrical and mechanical design, we propose to take the reader through the works in which is manufactured the apparatus which has found its way to nearly every town and village in the country. Following the necessary order in which material for such establishments takes its course, we find on the ground floor the office of the purchasing agent through whose hands all orders for the purchase of material and supplies of whatever nature must pass. Besides the chief a number of assistants are required to properly attend to this work, which, in a factory of this nature, daily requires many tons of material of every conceivable nature. From the office of the purchasing agent a few steps lead us to the domain of the storekeeper where all the supplies entering the building are registered and where all orders and requisitions from the



ONE CORNER OF THE RAILWAY MOTOR ASSEMBLING DEPARTMENT.

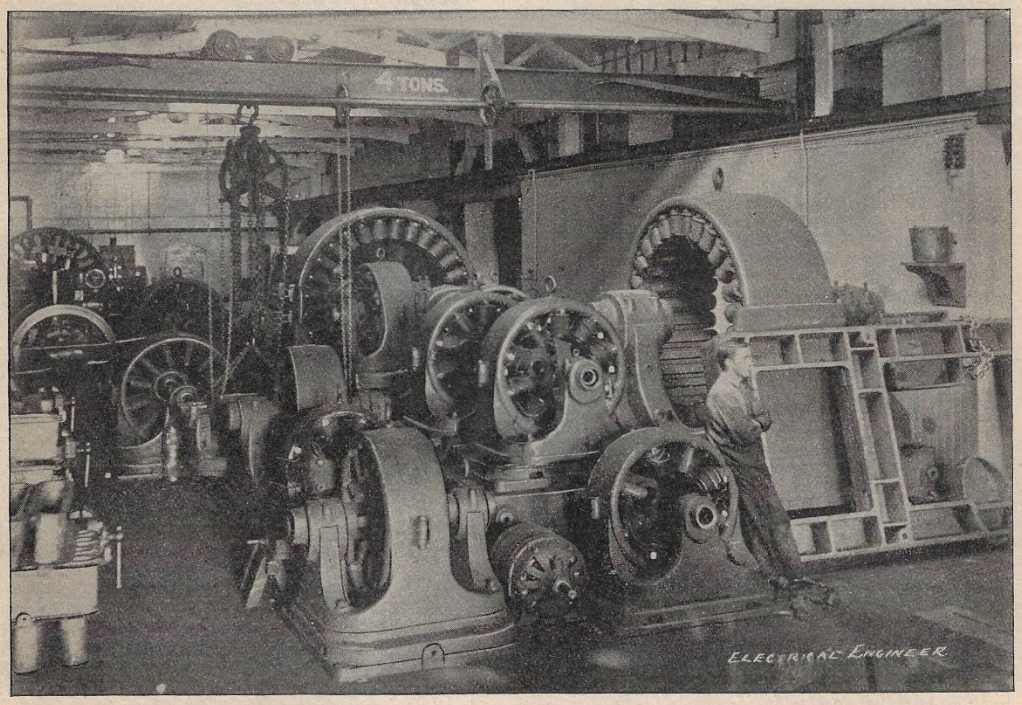
various factory departments are filled. In this storeroom we find rows upon rows of shelves and bins containing iron and brass screws, bolts, slate, marble and many tons of wire of all sizes stacked in great heaps; in addition the storeroom contains many of the finished parts which are kept in stock, such as brush-holders, armature ends, etc. Directly off from the storeroom is one of the numerous power and lighting plants which supply the various departments of the factory, this particular one being intended for the operation of the laboratory immediately overhead. This plant consists of two Westinghouse engines, one driving a continuous current machine and the other an alternator.

Passing beyond and ascending a few steps we reach the annealing department in which the sheet iron and steel employed in the construction of armature cores, converters, and the field magnet of the recently designed low frequency alternators are brought to the proper degree of softness. As much of the action of the machines depends upon the magnetic properties of the iron and steel employed, it is eminently necessary to bestow the greatest care on this part of the work, and for this purpose the sheets are packed into an annealing furnace and baked for from eight to ten hours at a uniform heat and then allowed to cool for six hours before removal from the ovens. Close besides these large annealing furnaces are others intended for the carbonizing of the lamp filaments. The filaments are packed into crucibles and baked in these furnaces heated by natural gas, and kept at an even temperature for many hours. They are then withdrawn to be further treated in the lamp department on an upper floor.

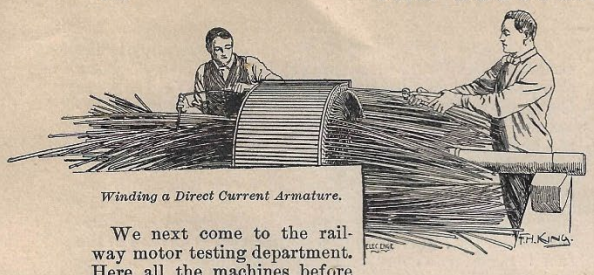
III.

A few steps further lead us to a most interesting display called the exhibition-room, in which a specimen of every apparatus and device manufactured by the Westinghouse Company is shown in practical operation. Here an attendant, by the turning of a switch, shows the manner in which the numerous mechanisms operate. The visitor learns by direct inspection the operation of the Shallenberger meter, and notes how its speed increases regularly with the addition of every lamp added to the circuit; at the same time the indicator and meter show the increased consumption of current, thus giving an optical demonstration of the fact that the true consumption is being recorded.

Another interesting part of the exhibition-room is the railway exhibit. In order to demonstrate, for example, the power and starting torque of the railway motor, the latter is connected with a dynamometer brake and scale, and by simply screwing up the brake the motor may be loaded to any desired capacity, while the visitor may compare the recording of the scale in pounds, and of the ammeter indicating the current. Added to this are several fully equipped trucks, double-reduction, single-reduction and gearless motors, together with platform switches. One of these trucks is also provided with an air brake operated by means of compressed air, supplied by a rotary air pump attached to the axle. A complete railway switchboard with automatic circuit-breakers completes this part of the exhibit. We might dwell at considerable length on the numerous devices which are shown in this interesting room, including the Tesla alternating motors, but must pass on to other departments of not less interest.



A View in the Erecting Shop—Westinghouse Electric Works, Pittsburgh.



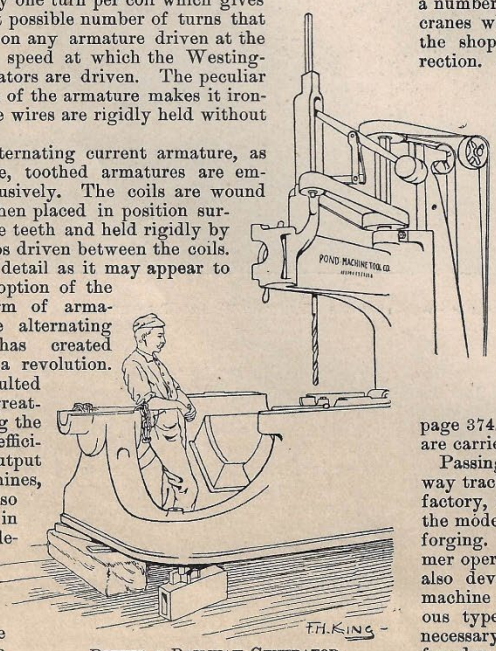
Winding a Direct Current Armature.

We next come to the railway motor testing department. Here all the machines before being shipped are given their final test, which determines not only their electrical but also their mechanical efficiency. For this purpose two machines are belted together; one operating as a motor and driving the other as a generator feeding a bank of lamps. Tests are now made at all speeds and loads; the conditions are then reversed, and the machine previously acting as a motor is driven as a dynamo by the other. Besides these mechanical tests, continuous tests for ground and other faults are carried out at a potential of 1,000 volts, that is, at twice the voltage normally supplied to the motors.

IV.

Just beyond the testing-room is the assembling department, where the fields and armatures are built up and fitted in their proper place. Our views on page 369 show a number of armatures in various stages of completion; and it will be noted that the toothed form of armature is now employed exclusively for alternating work; while for direct current the wires are placed below the external surface of the armature. A view on this page shows the operation of winding such a direct current armature. These armatures are wound with only two circuits, and all wires lying adjacent to each other are connected with adjacent bars of the commutator so that no high-tension wires touch each other at any place. There is only one turn per coil which gives the smallest possible number of turns that can be used on any armature driven at the low rate of speed at which the Westinghouse generators are driven. The peculiar construction of the armature makes it iron-clad, and the wires are rigidly held without band wires.

In the alternating current armature, as stated above, toothed armatures are employed exclusively. The coils are wound in a lathe, then placed in position surrounding the teeth and held rigidly by wooden stops driven between the coils. As small a detail as it may appear to be, the adoption of the toothed form of armature in the alternating machines has created practically a revolution. It has resulted not only in greatly increasing the electrical efficiency and output of the machines, but has also contributed in no small degree to their mechanical improvement. The wires held in position by the teeth are absolutely immovable, and a sudden overload does not, as formerly, lead to a straining of the wires. Besides, the ease of repairs made possible by the insertion of a new coil for a damaged one gives an additional value to this method of construction.



BORING A RAILWAY GENERATOR.

We have just remarked on the new departure seen in but a single detail of the machine, the armature, but we may observe the most interesting fact—and one demonstrating the thorough study to which the machines of the Westinghouse Company are constantly subjected—that hardly a single piece of apparatus now being built at these works is of exactly the same pattern as that built barely a year ago.

The railway motor assembling-room presents a busy scene, and an indication of the pressure of work in this department can be but vaguely conveyed by our illustration on page 370, which shows a pile of railway motor fields ready to be fitted with axle bearings.

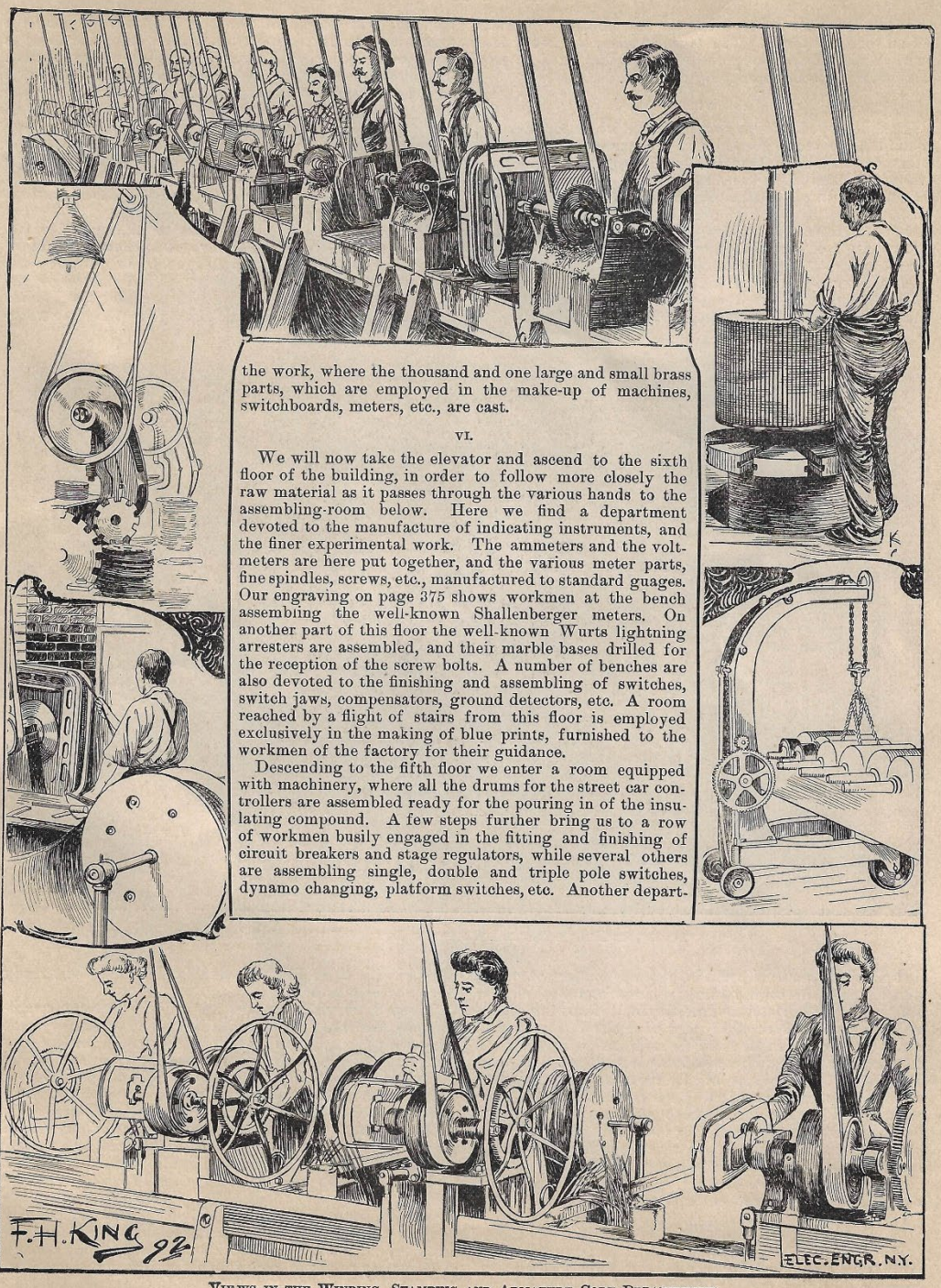
V.

The heavy machine tool shop, illustrated on page 374, occupies more than half the space of the square covered by the works. Our view on page 374 can give but an inadequate idea of the number and size of the machines here at work. Immense lathes, planers and boring mills finish the castings as they come from the foundry. And the handling of these heavy masses is very easily accomplished by a number of overhead cranes which traverse the shop in every direction. A large number of special tools are also at work, designed for the purpose of rapidly reducing the rough material to its finished shape, and thus effecting economy in time and cost of manufacture. Indeed, a notable feature of the equipment of the Westinghouse Works is the employment, wherever possible, of machines and devices for economizing time in manufacture, and also for the purpose of securing uniformity and interchangeability of parts. For this purpose, standard gauges are employed throughout the Works, so that when the parts are ready to assemble a touch of the file is scarcely required to fit them in their proper positions.

Finishing Slot in a Brush Holder.

At the north end of this machine shop a line of heavy shafting drives the large alternating and continuous current generators undergoing test, a partial view of which is also shown on page 374. These tests, like those of the railway motors, are carried out with great care.

Passing out from the heavy machine shop across the railway tracks, by which the material is shipped from the factory, we find the blacksmith shop, equipped with all the modern tools, such as steam and drop hammers for rapid forging. Among the tools here employed is a drop hammer operated by an electric motor. Separate buildings are also devoted to the carpenter shop, where the various machine patterns and the woodwork required in the various types of apparatus manufactured, are finished. A necessary adjunct of every electrical shop is a brass foundry. A separate building is devoted to this part of



VIEWS IN THE WINDING, STAMPING AND ARMATURE CORE DEPARTMENTS.

the work, where the thousand and one large and small brass parts, which are employed in the make-up of machines, switchboards, meters, etc., are cast.

VI.

We will now take the elevator and ascend to the sixth floor of the building, in order to follow more closely the raw material as it passes through the various hands to the assembling-room below. Here we find a department devoted to the manufacture of indicating instruments, and the finer experimental work. The ammeters and the voltmeters are here put together, and the various meter parts, fine spindles, screws, etc., manufactured to standard guages. Our engraving on page 375 shows workmen at the bench assembling the well-known Shallenberger meters. On another part of this floor the well-known Wurts lightning arresters are assembled, and their marble bases drilled for the reception of the screw bolts. A number of benches are also devoted to the finishing and assembling of switches, switch jaws, compensators, ground detectors, etc. A room reached by a flight of stairs from this floor is employed exclusively in the making of blue prints, furnished to the workmen of the factory for their guidance.

Descending to the fifth floor we enter a room equipped with machinery, where all the drums for the street car controllers are assembled ready for the pouring in of the insulating compound. A few steps further bring us to a row of workmen busily engaged in the fitting and finishing of circuit breakers and stage regulators, while several others are assembling single, double and triple pole switches, dynamo changing, platform switches, etc. Another depart-

ment on this floor is devoted to the assembling of rheostats of all sizes and forms. The German silver or heavy iron wire is supported on porcelain insulators fixed in iron frames, so as to be thoroughly fireproof.

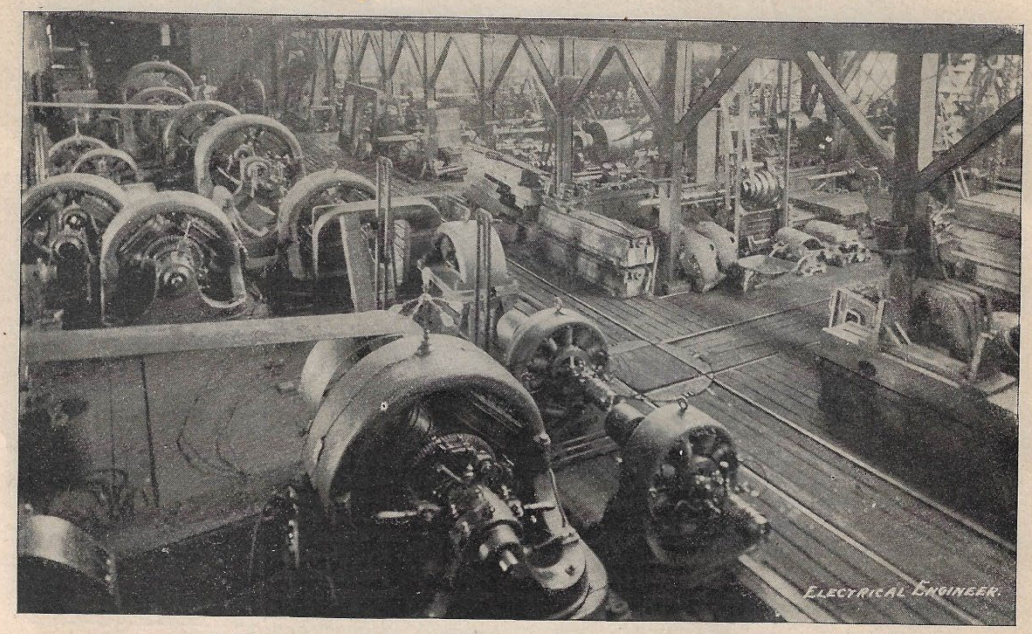
VII.

Passing beyond the heavy fire wall which divides the building, we enter the converter department. Here the stamped sheets of soft steel are built up around the converter coils and pressed into a solid mass. The employment of soft steel in place of iron has resulted in a great increase in the output, as well as in the efficiency of these converters. The method of building up these sheets without the interposition of paper or other auxiliary insulating material might at first thought give rise to unfavorable criticism, and, not very long ago, would have been considered little short of suicidal. But it was Mr. Albert Schmid, the superintendent of the Westinghouse Works, who discovered that the sheet material could be given a coating of oxide, which would thoroughly insulate plate from plate electrically, and thus obviate the necessity of interposing sheets of paper as had heretofore been done; and this method is now carried out in all the Westinghouse laminated work, not only in converters but also in armatures and laminated pole-pieces. At one side of the room a complete testing outfit is arranged for subjecting the converters to a thorough test before allowing them to go out. For this purpose each transformer is run for four hours at 20 per cent. beyond its rated capacity. On this floor also, the laminated pole-pieces intended for the new low-frequency Westinghouse alternator are built up, to be afterwards cast into a ring frame, forming a continuous magnetic yoke.

VIII.

We now enter the tool-room, that important part of every large manufacturing establishment, where all cutters, punches, dies, jigs, etc., are finished to be delivered to the machinists in charge of the machine tools. Among the numerous excellent tools with which this department is equipped, may be noticed two oscillating emery planers. These machines, which are constantly at work, are built to handle large surfaces, such as are presented by the dies intended for punching out large armature plates. The object to be surfaced is fixed to a planer bed, and the emery wheel, besides its ordinary motion of revolution, is given a transverse motion at right angles to the bed of the planer; thus each part of the wheel is brought into action. This keeps it true automatically, and thus insures a thoroughly plane surface.

Retracing our steps and passing to the fourth floor below, we enter the department devoted to the assembling of armature cores. These are put together much in the same way as the converter cores, being placed one above the other in the shaft, and pressed into a solid mass. Then the ends are screwed on them and they are passed to workmen who file them down thoroughly and finish them ready for the reception of the winding.



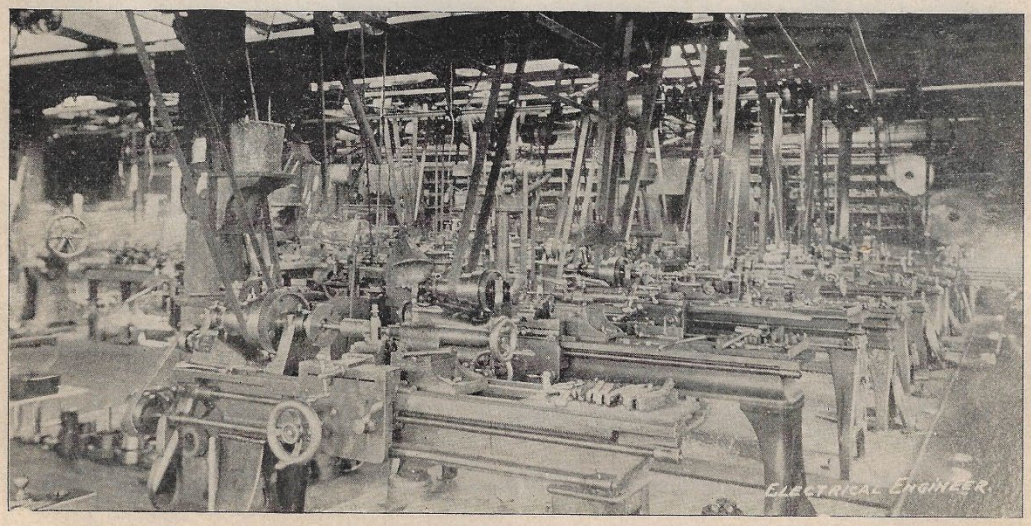
A Corner of the Heavy Machine Shop and Dynamo Testing Department.

The work in this department, as well as in others throughout the factory, is greatly facilitated by the employment of portable cranes. By means of these an armature core weighing several hundred pounds is lifted directly into a lathe and requires only a boy for its manipulation. One of these cranes is shown on page 373. An interesting process, and one illustrating the care which is bestowed upon the details of manufacture in the Westinghouse Works can be seen here. In finishing the slots of the brass brush holders much time would be required in filing, as machine work is practically impossible in this case. To save the time which would be thus occupied, steel cutting plugs are employed, which the workman drives through the slots by blows of a hammer. The operation is shown in our engraving, page 372, and the result is a perfectly smooth slot, exactly to gauge, and which requires not a touch of the file.

Passing through a partition, which keeps out all dust, we enter the rooms devoted to the testing of voltmeters, am-

ASSEMBLING SHALLENBERGER METERS.

meters, station indicators, circuit breakers, as well as house meters. All these instruments are subjected to a thorough test and compared with standard instruments.



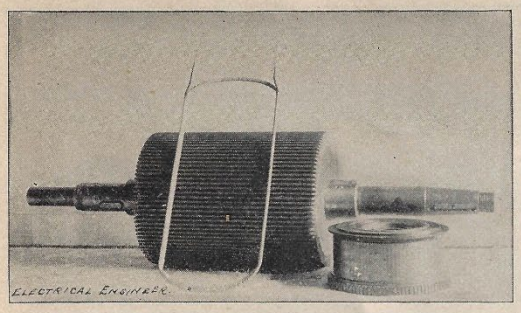
A SECTION OF THE TOOL ROOM.

Thus, the house meters are given a prolonged run, and their indications are continually checked by the reading of an electro-dynamometer. The durability and the careful construction of all the Westinghouse apparatus are strikingly illustrated in this meter. As has been already stated, there are now meters in operation measuring the current of nearly 1,000,000 16 c. p. incandescent lamps, and less than one per cent. of this total amount sold has ever been returned to the shop for any defect whatsoever.

IX.

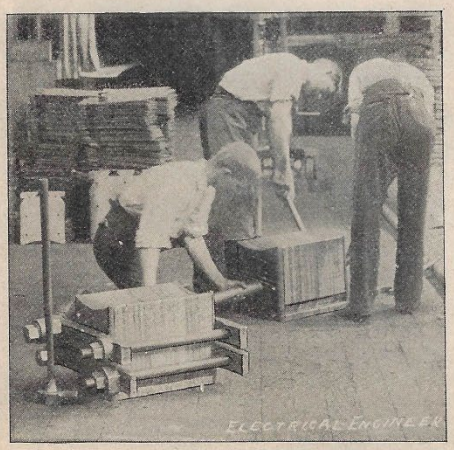
Passing through the portals protected by heavy fire doors, we enter the armature winding department. Here the cores are first thoroughly covered with Fuller board and can-

vas soaked in insulating material and the coils then applied. One of our engravings shows a railway armature in three



RAILWAY ARMATURE CORE COIL AND COMMUTATOR.

stages of progress of winding. The employment of specially wound coils for the railway armatures makes their winding very simple, and permits of easy replacement in case of damage, a process which involves some difficulties in the ordinary Siemens wound drum. Close beside are a number of benches devoted to the winding of the small solenoid coils of the Westinghouse arc lamps. When finished they are brought to the front of the building, which constitutes the assembling and test room for arc lamps, a view of which is given on page 377.



BUILDING UP LAMINATED POLE-PIECES FOR RAILWAY GENERATORS.

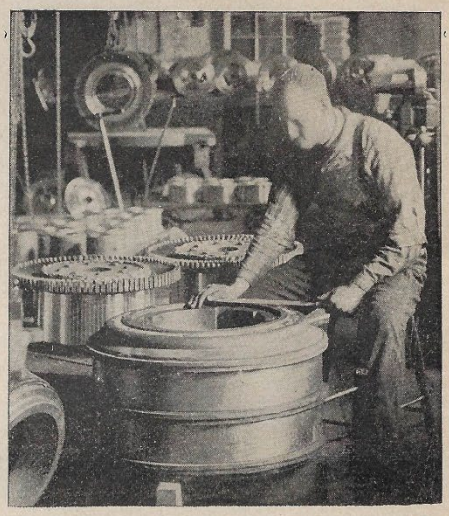
On another part of this floor the car controllers are assembled. The interstices between the contacts are filled with insulating compound, giving the whole a perfectly cylindrical surface. Partitioned off from the rest of the work on this floor is the buffing shop where the many small parts are polished, ready to be lacquered.

X.

The winding of the field magnet coils for the various types of generators and motors, as well as those intended for converters is done on the third floor. Our engraving, on page 373 show clearly this operation which requires a considerable amount of skill and care. Each layer of wire is thoroughly insulated from its neighbor. The spools placed between lathe centres are driven by a belt from overhead, workmen guiding the wire into the proper channel as the spool revolves. During our visit this department was driven to its utmost capacity owing to the heavy demand for prompt delivery, especially of the electric railway apparatus, for which there is simply an enormous demand.

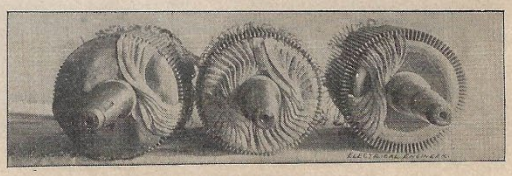
XI.

The filaments employed in the lamp manufacture are made in the Pittsburgh factory. As they come from the carbonizing furnaces, they are delivered to girls who place each filament in clips which are then



FINISHING AN ALTERNATING CURRENT COLLECTOR.

covered by a glass globe from which the air is first exhausted by means of vacuum pumps. After the air is exhausted, hydrocarbon gas is admitted; the current being then turned on, the filament is brought to incandescence and the deposit of carbon from the hydrocarbon gas ensues. The flashing process gives the filament a uniform texture through its entire length, and when the proper resistance has been reached, the current is automatically cut off. Each girl operates two stands, one of these exhausting and the other flashing. In addition to the automatic arrangement for obtaining the correct resistance,

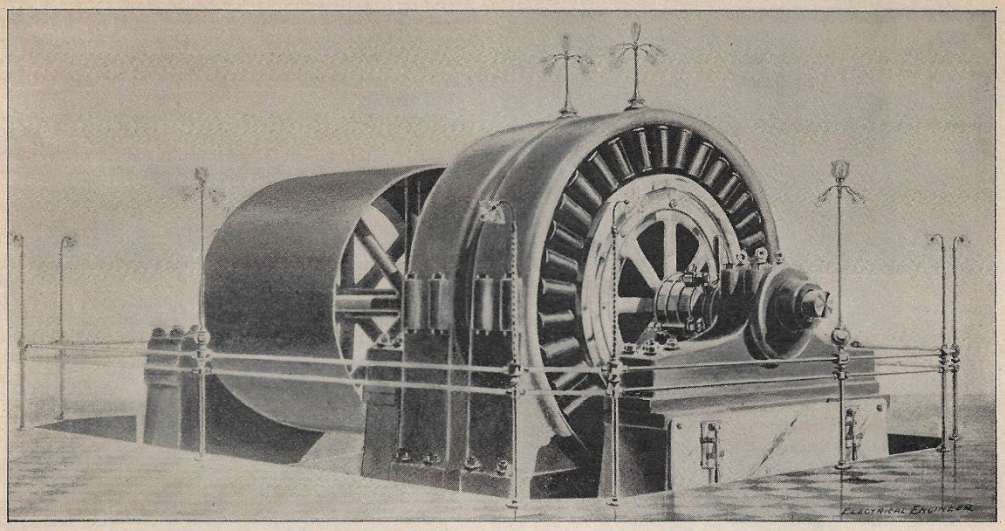


RAILWAY MOTOR ARMATURES.

each filament is additionally measured by means of a Wheatstone bridge.

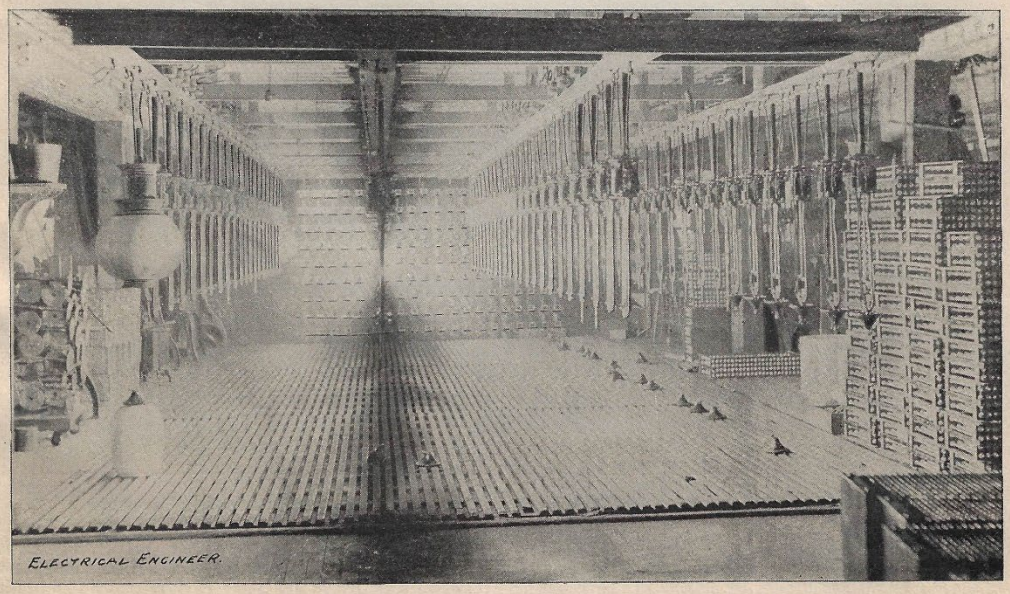
Adjoining the flashing department is the experimental

shop where work is constantly going on to devise improvements in lamp manufacture.



10,000-LIGHT BELT DRIVEN ALTERNATOR FOR THE WORLD'S COLUMBIAN EXPOSITION.

The other side of the building on this floor is occupied by a series of gear cutters which operate automatically; the gear blanks, once inserted, require no attention until the gear teeth are finished. Here also, the gear cases which protect the gears from dust under the cars, and serve to deaden the noise of the gears, are fitted. The commutator and collector departments are also situated on this floor and offer a striking object lesson on the comparative simplicity and cheapness of construction of the latter as compared with the former.



TESTING ROOM FOR ALTERNATING ARC LAMPS.

XII.

Passing to the floor below, an army of girls may be seen

taping and insulating the converter, field magnet and armature coils. The field magnet coils are first thoroughly

A View in the Drafting Room.

shellacked, then covered with Fuller board, and wound with insulating tape and finally dipped in a special insulating compound. The primary and secondary coils of the converters are wound separately and then slipped over each other before insertion in the iron cores. This feature of separately winding the primary and secondary coils of the converters is controlled by patents of the company and by this means the greater durability and higher efficiency of the Westinghouse converters is largely assured. As we pass through the room we notice a long bench at which girls are sorting and cutting mica sheets which enter into the insulation of the commutator segments and a variety of other apparatus.

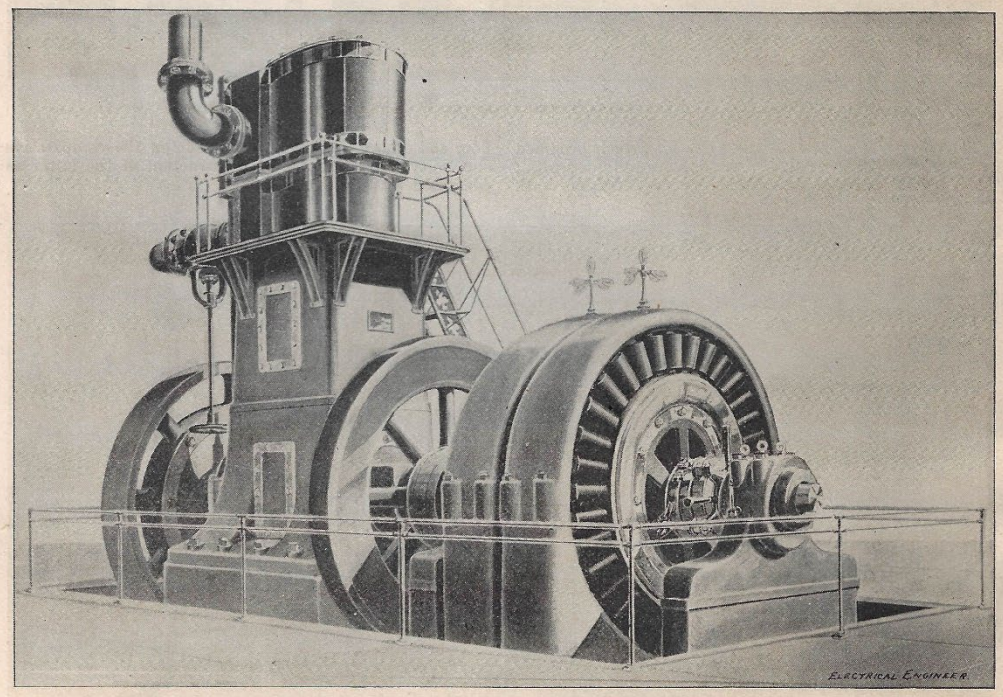
In the room adjoining this department we find a very interesting experimental high tension plant in which converters are coupled up to give any potential up to 100,000 volts. Directly off from this is the drafting-room, a view of which is given on this page and in which all the details are worked out under the direct supervision of Mr. E. C. Means.

Passing to the south end of the building we come to the punching or stamping department. Here the sheets of iron and steel of which the converters and armatures are made are first sheared, then stamped out ready to be sent to the assembling departments.

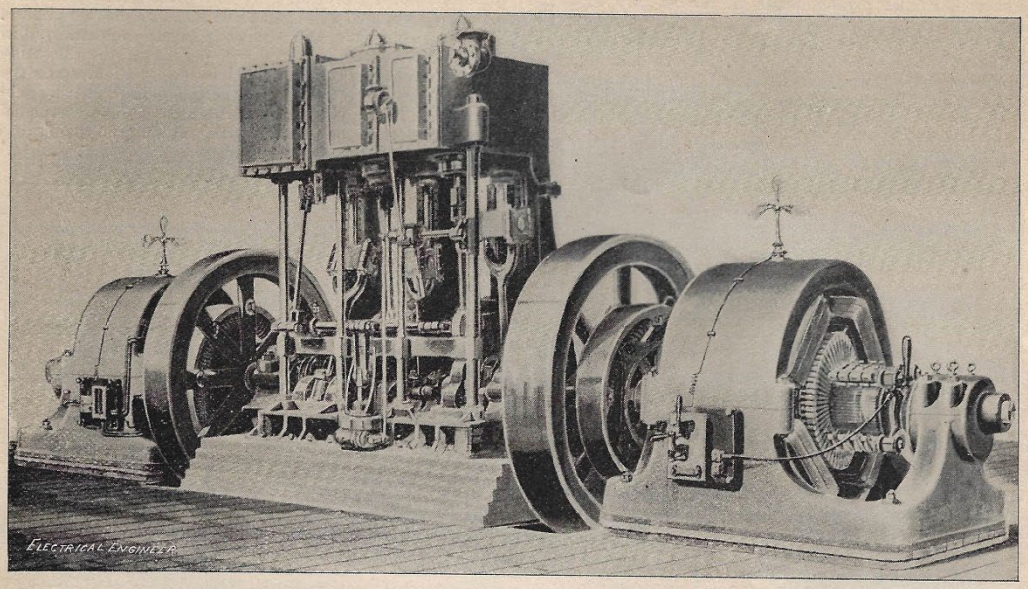
XIII.

In this hasty walk through the building the visitor is everywhere impressed with the thorough, systematical handling of all apparatus and material, without which, of course, there can be no economy in manufacture. His attention in this connection is also attracted by the extreme cleanliness observed. Dust, the great enemy of electrical apparatus, especially in the course of its manufacture, is effectively combatted, not by the usual brush, but by a complete system of compressed air piping. This is tapped at innumerable points and by flexible tubing, is brought by the workman to the necessary points. The strong blast blows all dust out of holes and cavities which to a brush would be inaccessible.

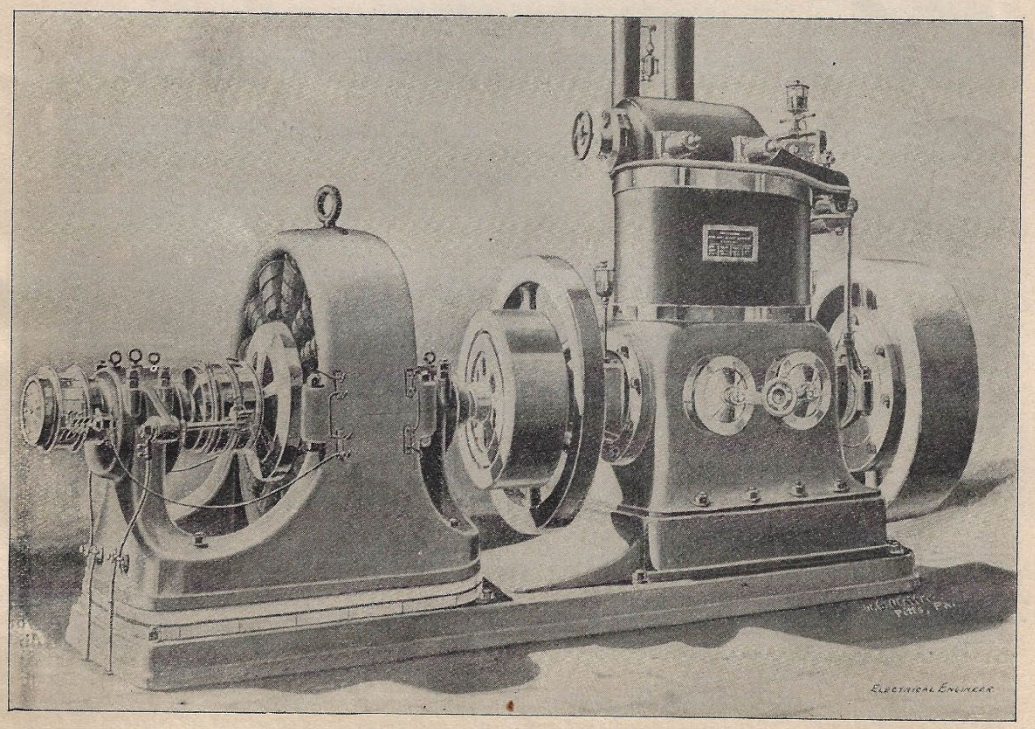
The welfare of the workmen is also thoroughly considered and the neat porcelain enameled wash-basins and polished faucets in every department will stand compari-



1,000 H. P. Westinghouse 2,000-Volt Quarter Phase Generator, for World's Columbian Exposition.



TWO 250 H. P. WESTINGHOUSE MULTIPOLAR RAILWAY GENERATORS DIRECT CONNECTED TO GLOBE IRON WORKS TRIPLE EXPANSION ENGINE.



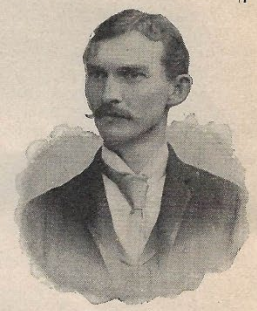
WESTINGHOUSE ALTERNATOR DIRECT CONNECTED TO WESTINGHOUSE ENGINE.

son with similar arrangements in almost any first-class hotel.

In our passage from shop to shop we pass through the office of the superintendent, Mr. Albert Schmid, who kindly explains the various details of the apparatus manufactured and the reasons for designs such as we find them. Here we are also shown the plans of some of the work which the Westinghouse Company is now engaged on, for supplying the World's Columbian Exposition, at Chicago, with light and power. The power plant which will be there shown will be a striking example of large power units in various types of generators; four of these will be driven direct by the new type of the Westinghouse vertical compound engine. The armatures of these machines will be of the toothed type, with removable coils and composite wound for constant potential. Besides this there will be six machines, belt driven, one of which will be a thousand horse power, quarter phase, alternating generator operating at 2,000 volts and 7,200 alternations per minute. This departure from the frequency heretofore employed in the Westinghouse apparatus will permit of the operation on the same circuit of arc and incandescent lamps and the Tesla motors as well. Besides this, a 500 h. p. railway generator will be shown coupled direct to a cross-compound Reynolds-Corliss engine operating at only 90 revolutions per minute. Our engravings on pages 377, 378, 379 and 382, will give a good idea of the magnitude of this work.

Philip Lange.

Albert Schmid.

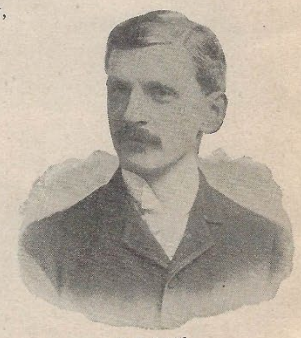


O. B. Shallenberger.

TECHNICAL STAFF;
WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY,
PITTSBURGH, PA.

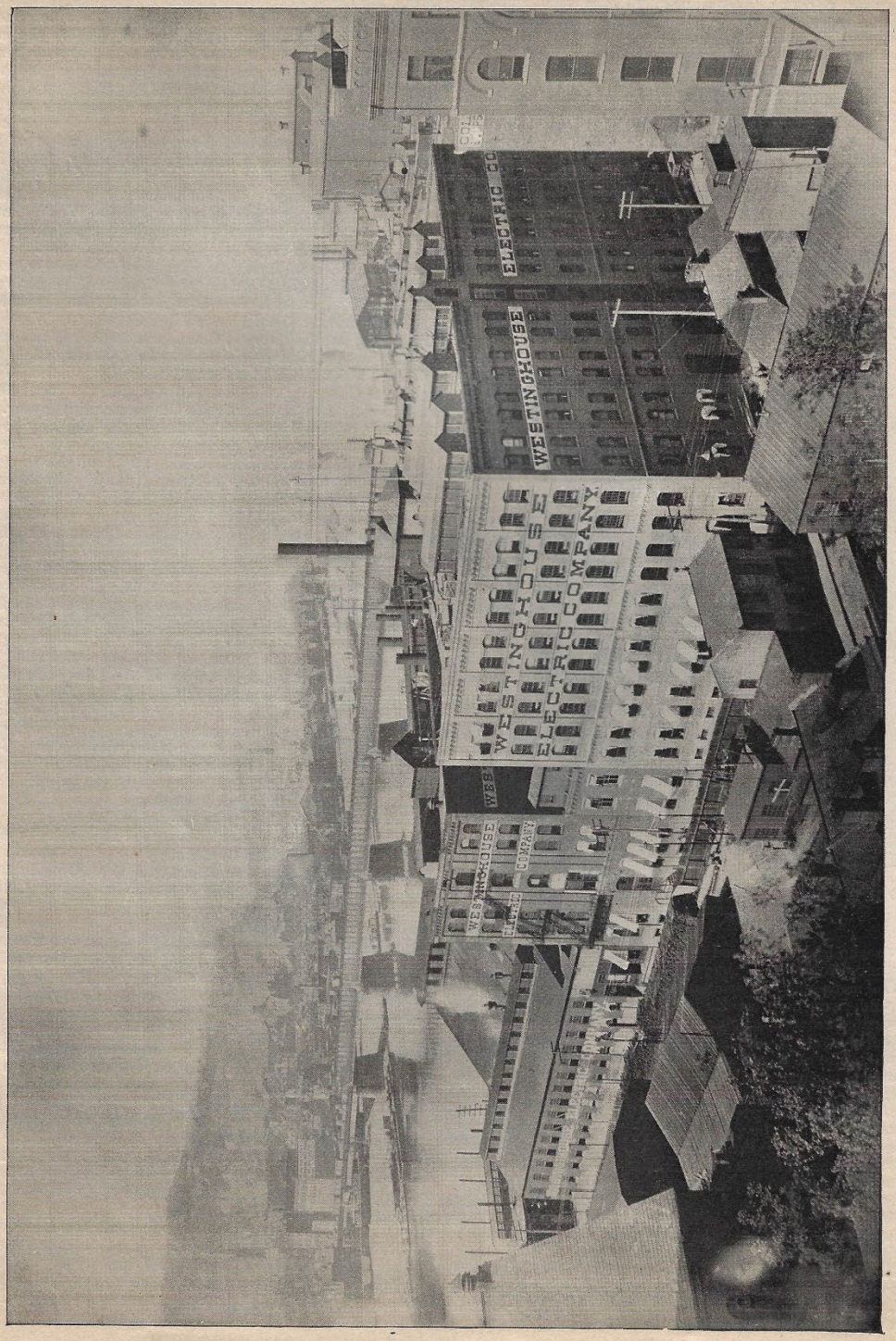
C. F. Scott.

L. B. Stillwell.



F. S. Smith.

The laboratory of the works, now under the direct charge of Mr. Charles F. Scott, is situated immediately above the main offices. Here the electrical details of all the apparatus are worked out. The laboratory also constitutes the standardizing bureau for all electrical shop instruments of every description and various investigations are constantly going on. The equipment of the laboratory



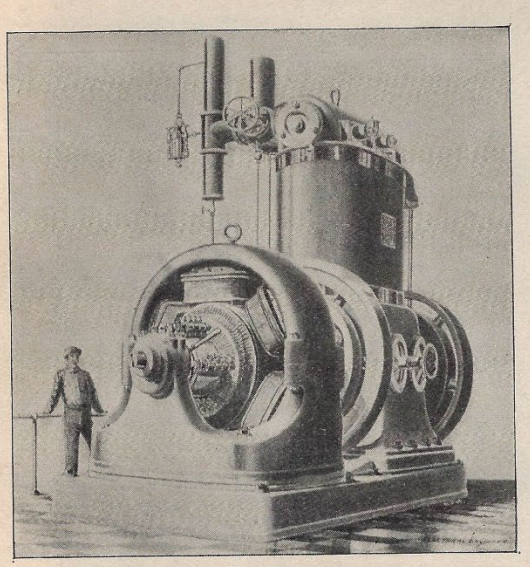
General View of the Westinghouse Electric Company's Works; Pittsburgh, Pa.

comprises a complete equipment of the most modern standard apparatus of both continuous and alternating type.

XIV.

No account of the work of the Westinghouse Company would be complete without a few words regarding the men who have contributed to bring the apparatus to the perfection which it now exhibits. We have already alluded to Mr. Nikola Tesla, whose recent enthusiastic reception in Europe is one of the most striking episodes in modern electrical history.

The technical staff of the Westinghouse Company may be said to offer a striking example of the value and demand for technical training, for without exception the heads of all departments are men who are graduates of colleges. This forms a striking contrast to conditions presented in manufacturing establishments of many older industries in which they who are frequently misnamed "practical men," or



500 H. P. Railway Generator Direct Connected to Westinghouse Engine.

those who have graduated from the machine shops, rule the destinies of manufacturing works.

The mechanical superintendent of the works, Mr. Albert Schmid, was born at Zurich, Switzerland, in 1858, and graduated from the celebrated Polytechnic in that city. In his early career he obtained considerable experience in the manufacture of steam engines, locomotives, turbines and electrical apparatus, widening his experience by sojourns in England, France, Belgium, Switzerland and Germany. In 1882, Mr. Westinghouse induced Mr. Schmid to come to Pittsburgh, where he entered the employ of the celebrated Westinghouse Air Brake Co. Upon the organization, shortly after, of the Westinghouse Electric Co., Mr. Schmid was placed in charge of the manufacturing department which position he has held ever since. In conjunction with Mr. Westinghouse, Mr. Schmid justly shares not a little of the credit for the admirable construction and design of the Westinghouse apparatus.

Mr. O. B. Shallenberger, the electrician of the Westinghouse Company, was born in Rochester, New York, and is still a young man, having now but reached his thirty-second year. At the age of seventeen Mr. Shallenberger entered the U. S. Naval Academy at Annapolis, where he graduated in 1881, and immediately thereafter went on the customary cruise to the European stations. After two years' service, however, he resigned his commission and was engaged in the experimental work of the electrical department of the Union Switch and Signal Co., which at that time had undertaken the manufacture of the Stanley continuous current apparatus. Upon the organization of the Westinghouse Electric Company, in January, 1886, Mr. Shallenberger was appointed chief electrician; which position he still holds. Mr. Shallenberger is the inventor of many features which characterize the Westinghouse apparatus as now made and of which his beautiful alternating current meter is probably the most important.

Mr. L. B. Stillwell, now in charge of the power transmission work of the Westinghouse Company, is a native of Scranton, Pa., where he was born in 1863. He passed successively through the Scranton High School, the Wesleyan University at Middletown, Conn., and finally took a special course in electrical engineering. In October, 1886, Mr. Stillwell was appointed assistant electrician to the Westinghouse Company, and occupied the position until 1889, since which time he has acted as its electrical engineer. In 1890, Mr. Stillwell was sent abroad by the company to act as consulting engineer for the Westinghouse Electric Company, Limited, in London, England, and also to study the development of the electrical industry in Europe. More recently Mr. Stillwell has devoted his attention particularly to the study of long-distance power transmission, for which purpose he has recently undertaken extensive trips South and West.

Mr. Philip Lange, superintendent of the detail department of the company, was born in 1856. For seven years he was engaged in the manufacture of instruments in Berlin, Germany, and in 1880 entered the celebrated works of Siemens Bros. & Co., of Woolwich, England, devoting his attention to the manufacture of submarine cables and arc lamp work. Coming to America in 1882, he entered the service of Messrs. Bergmann & Co., of New York, who at that time manufactured the smaller details of the Edison system of lighting. He remained there four years, until 1886, when he entered the service of the Westinghouse Company at Pittsburgh. Here Mr. Lange was placed in charge of the "detail department," developing and working out the details of alternating and street car systems. During the last year Mr. Lange has acted as assistant to Mr. Schmid, and as such is now in charge of the works in Newark, N. J., where he has been since July of this year.

Mr. Charles F. Scott was born in Athens, Ohio, in 1864, and graduated at the Ohio State University, Columbus, in 1885. He then took a course of graduate work at the Johns Hopkins University, after which he entered the electrical field with a constructing company in Philadelphia in 1887. In August, 1888, Mr. Scott entered the employ of the Westinghouse Company in Pittsburgh, beginning work in the dynamo-room on night duty. He was soon transferred to the laboratory, and was assistant to Mr. Tesla during the latter part of his work on alternating motors at Pittsburgh. After the departure of Mr. Tesla, Mr. Scott was placed in charge of experimental work on the Tesla motor. Mr. Scott has been assistant electrician for the last year in charge of the laboratory, and part of the time during the absence of Mr. Shallenberger.

The superintendent of the lamp department, Mr. F. S. Smith, was born in 1863, at Kingston, Pa. In 1882 he entered the Wesleyan University at Middletown, Conn., taking a two years' course of chemistry and the natural sciences; he then proceeded to Lehigh University at Bethlehem, Pa., where he took a course in analytical chemistry, graduating in 1887. On June 1, of that year, he entered the service of the Westinghouse Company as assistant superintendent of the lamp factory, which position he held for a number of years. Mr. Smith then took charge of the

experimental work in incandescent lamps, to which he devoted a year, and since then he has been superintendent of the lamp department, in addition to that of the experimental work.

Mention must also be made here of Messrs. B. G. Lamme, E. C. Means and H. P. Davis, who have been connected with the Westinghouse Company for a number of years, and who have ably assisted Mr. Schmid in the designing of the Westinghouse apparatus.

In the above we have limited ourselves to the description of but one of the manufacturing establishments of the Westinghouse Co. But some detailed mention must also be made of the factory in Newark, N. J. These works, which are in charge of Mr. Philip Lange, cover nearly an entire block, and are five stories high. It is here that the large direct current dynamos for isolated lighting, electrolytic work, etc., are manufactured, and, also, motors of all sizes.

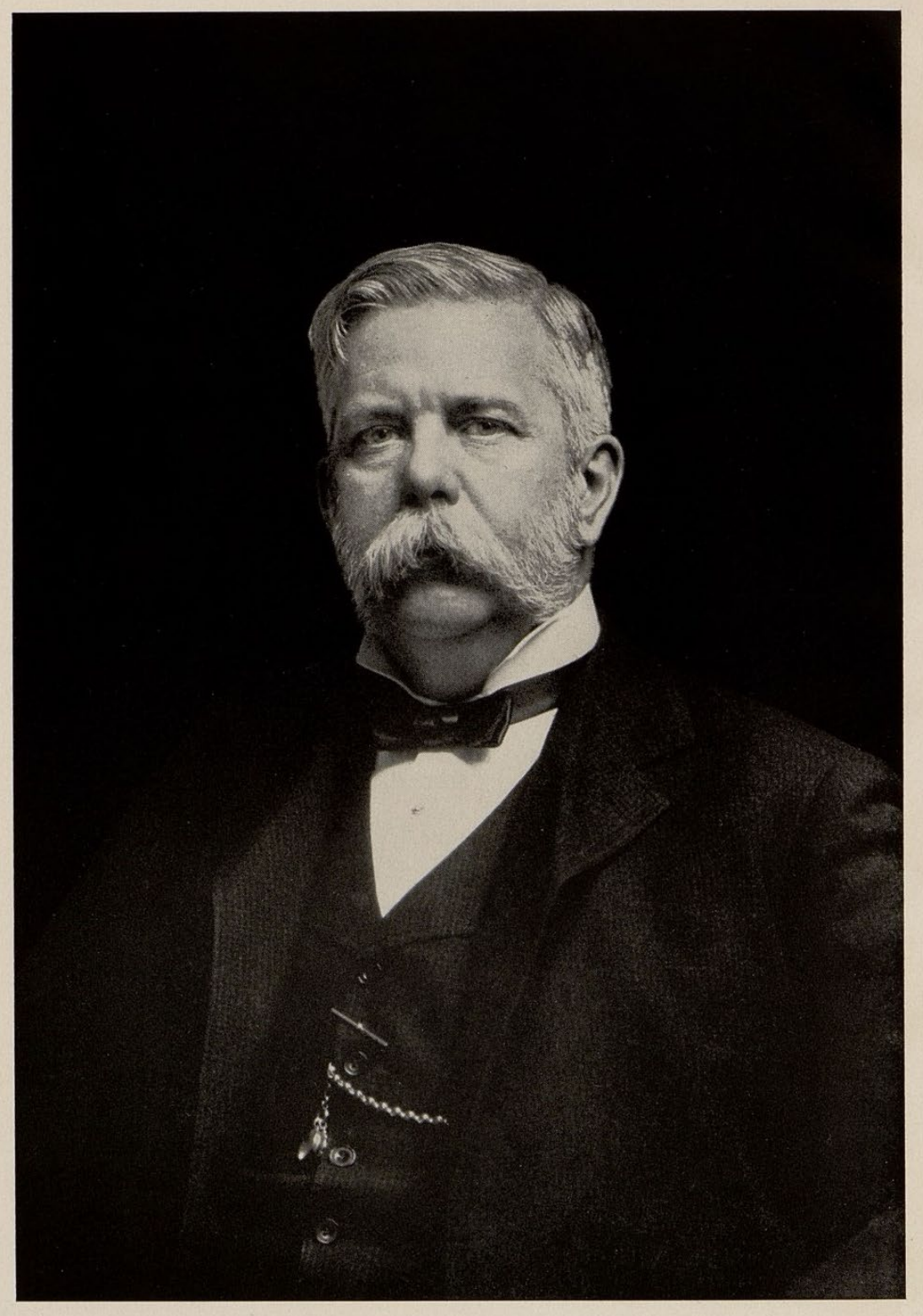
XV.

In the foregoing the writer has endeavored to give, as nearly as possible, an accurate description of the most important departments of the works of the Westinghouse Electric and Manufacturing Company in Pittsburgh. It is not meant to be a complete description of everything he saw there, indeed such a task, while it would be a pleasant one, would make this issue of the ENGINEER much too bulky. It is safe to say that there is no other electric company in the world, the product of which affords more of interest to the electrical industry and the public in general, than does that of the Westinghouse Company.

Rarely, indeed, is there a manufacturing company, either in the electrical or any other industry, which in the short space of time, of less than a decade, can produce a record of achievements equal to that of the Westinghouse Company. Their product has in that time been sold in every corner of the globe. Their apparatus is operating in gold mines in Colorado, in coal mines in Pennsylvania; it generates electric current for lighting one of the largest parts of the city of London, England, as well as towns in China, Japan and Australia. Its apparatus for the operation of electric railways has within two years revolutionized the entire manufacture of electric motor systems. There is, in fact, not a branch or a field in the electrical industry that is not occupied by this enterprising corporation.

Reprinted from THE ELECTRICAL ENGINEER,

203 BROADWAY, NEW YORK.



GEORGE WESTINGHOUSE, 1846-1914.

GEORGE WESTINGHOUSE COMMEMORATION

A FORUM PRESENTING THE CAREER
AND ACHIEVEMENTS OF GEORGE WESTINGHOUSE
ON THE 90th ANNIVERSARY OF HIS BIRTH

CONDUCTED BY

THE AMERICAN SOCIETY OF
MECHANICAL ENGINEERS

December 1
1936

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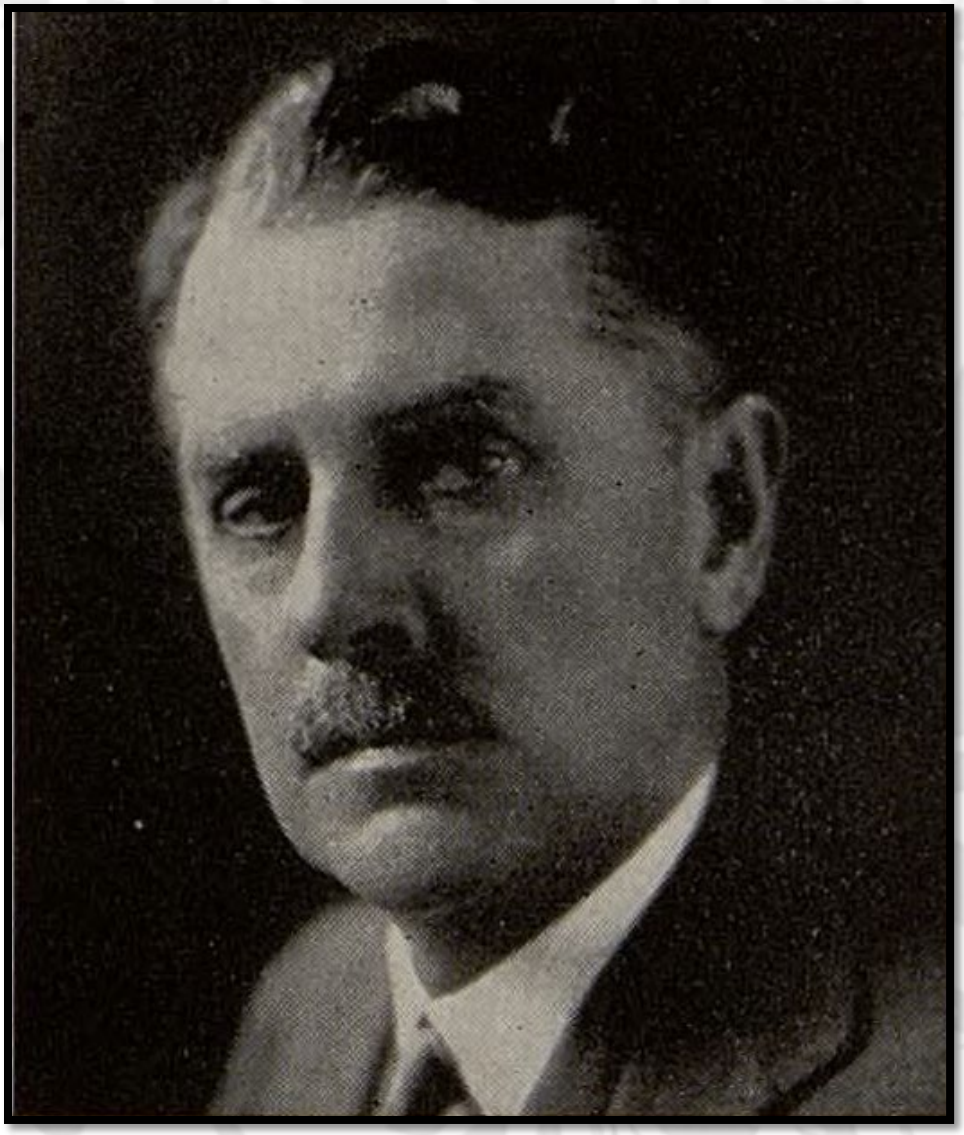
NEW YORK
1937

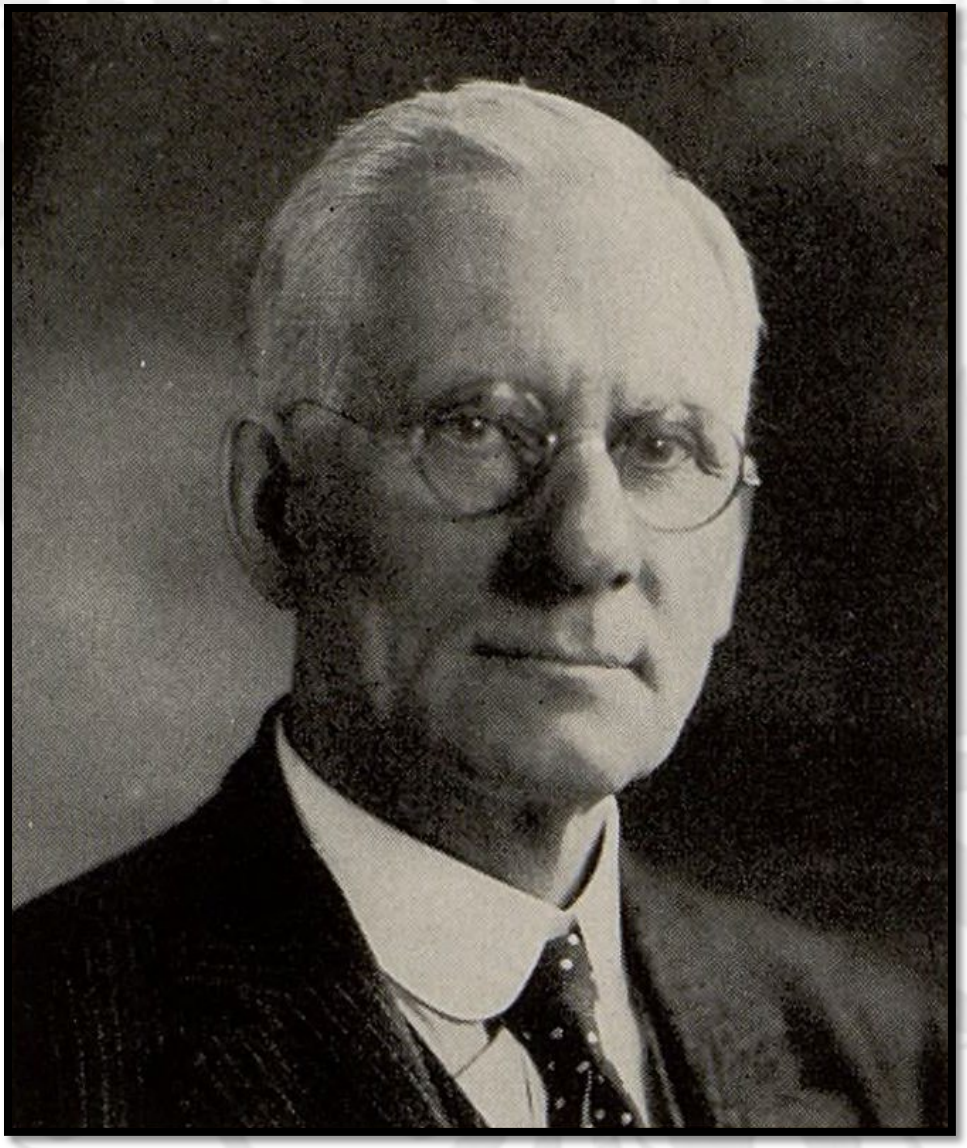
ON THE PLATFORM FOR THE WESTINGHOUSE FORUM
AFTERNOON EXERCISES

Standing (left to right): JOHN F. MILLER, N. W. STORER, THOMAS CAMPBELL, FRANCIS HODGKINSON, A. W. BERRESFORD, C. R. BEARDSLEY, ROY V. WRIGHT, CHARLES F. SCOTT. *Seated:* L. B. STILLWELL, W. W. NICHOLS, FRANK W. SMITH, E. R. HILL, J. V. B. DUER, SAMUEL M. VAUCLAIN.

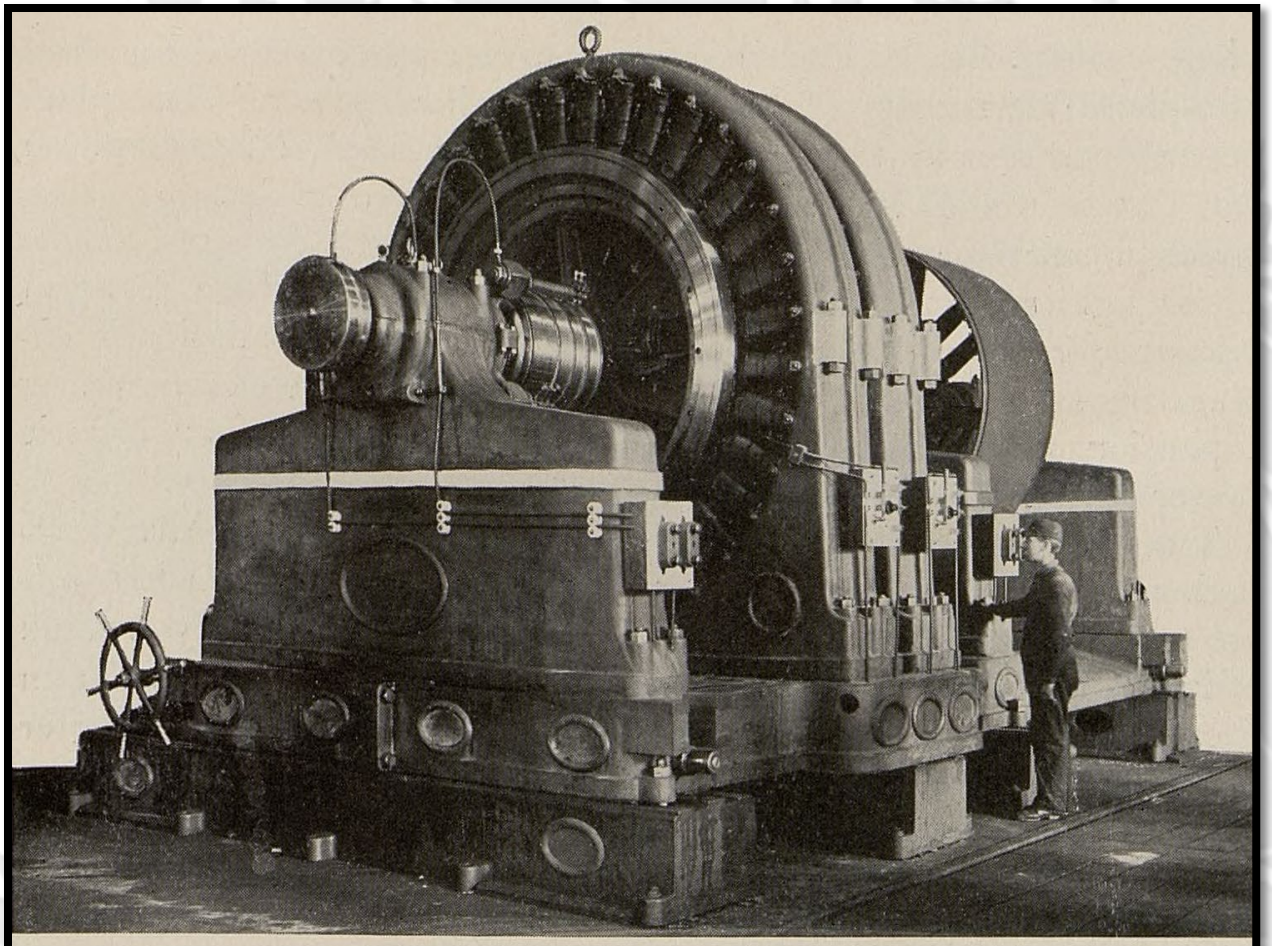
From George Westinghouse Commemoration, 1937



L. B. Stillman, from George Westinghouse Commemoration, 1937

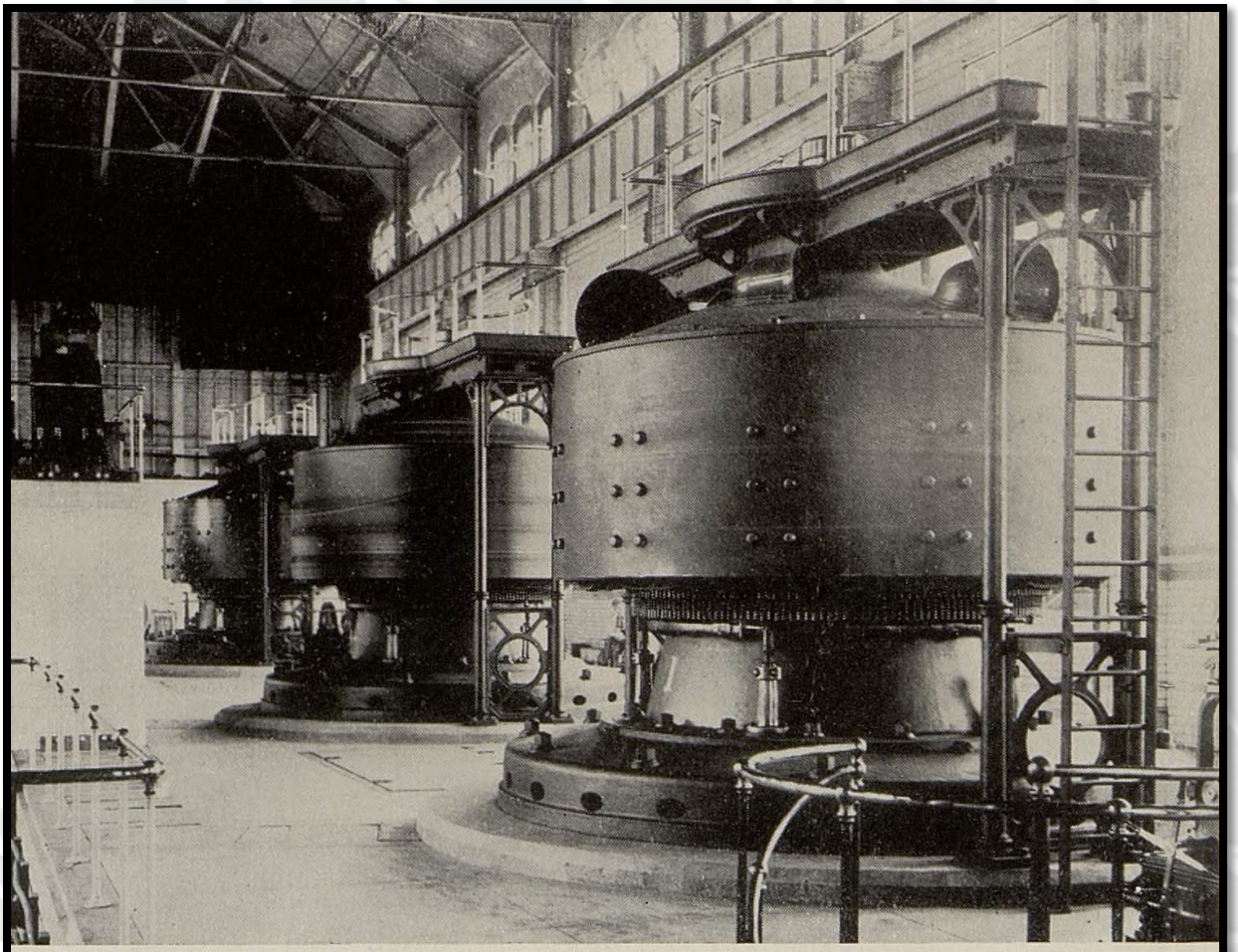


Charles F. Scott, from George Westinghouse Commemoration, 1937



750 KW. ALTERNATING-CURRENT GENERATOR THAT SUPPLIED ELECTRICITY FOR THE CHICAGO WORLD'S FAIR, 1893.

From George Westinghouse Commemoration, 1937

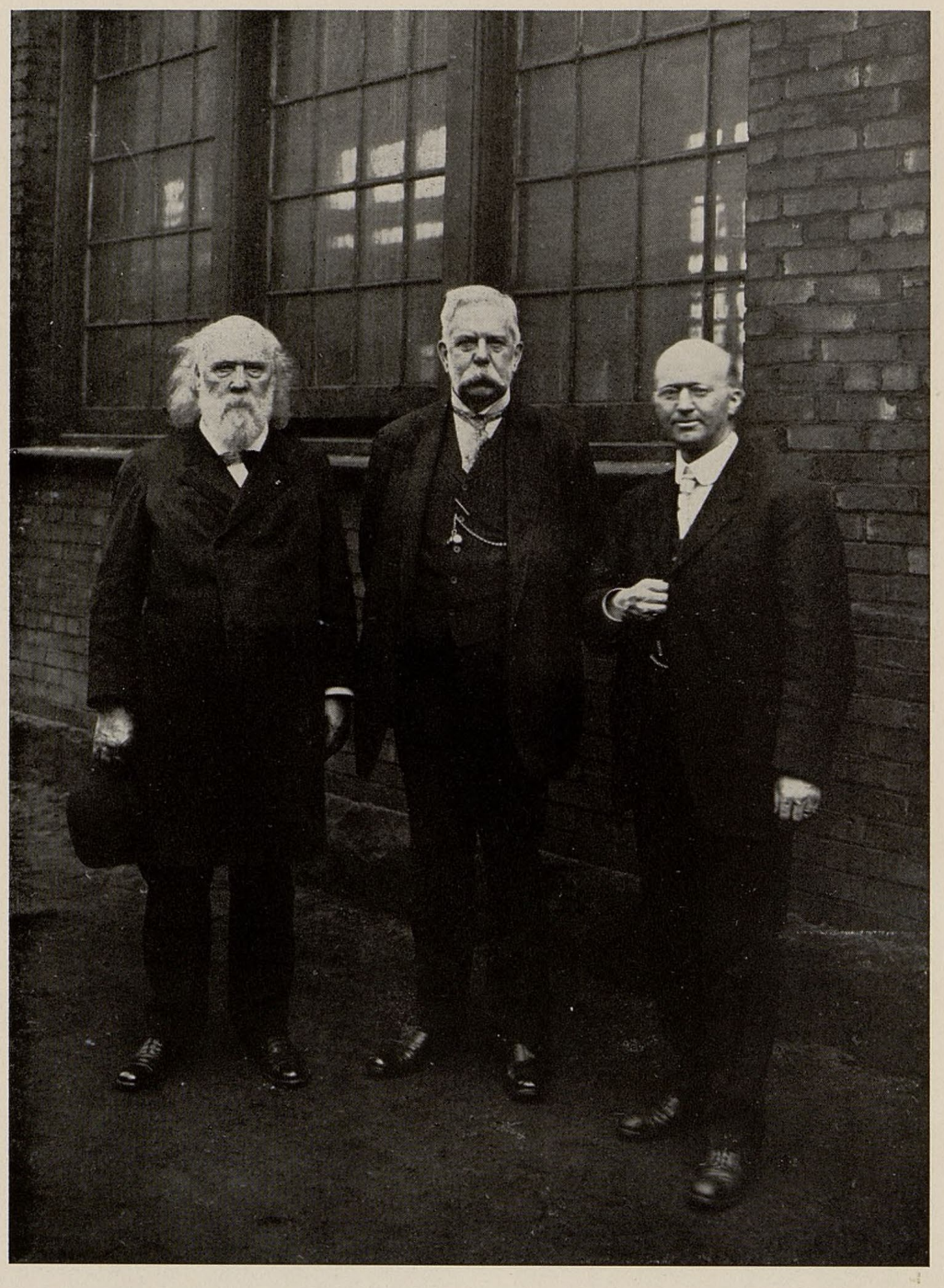


FIRST ALTERNATING-CURRENT GENERATORS INSTALLED AT NIAGARA FALLS, 1895.

From George Westinghouse Commemoration, 1937

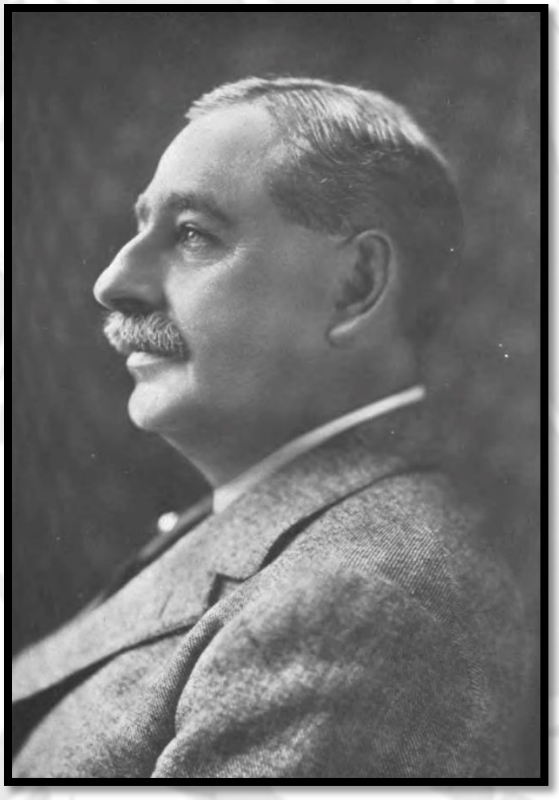
ILLUMINATION OF THE CHICAGO WORLD'S FAIR, 1893—ONE OF THE DRAMATIC ACHIEVEMENTS OF GEORGE WESTINGHOUSE'S CAREER.

From George Westinghouse Commemoration, 1937



REAR ADMIRAL GEORGE W. MELVILLE, U. S. N., GEORGE WESTINGHOUSE, AND JOHN H. MACALPINE, WHO COLLABORATED IN APPLYING STEAM TURBINES TO MARINE SERVICE.

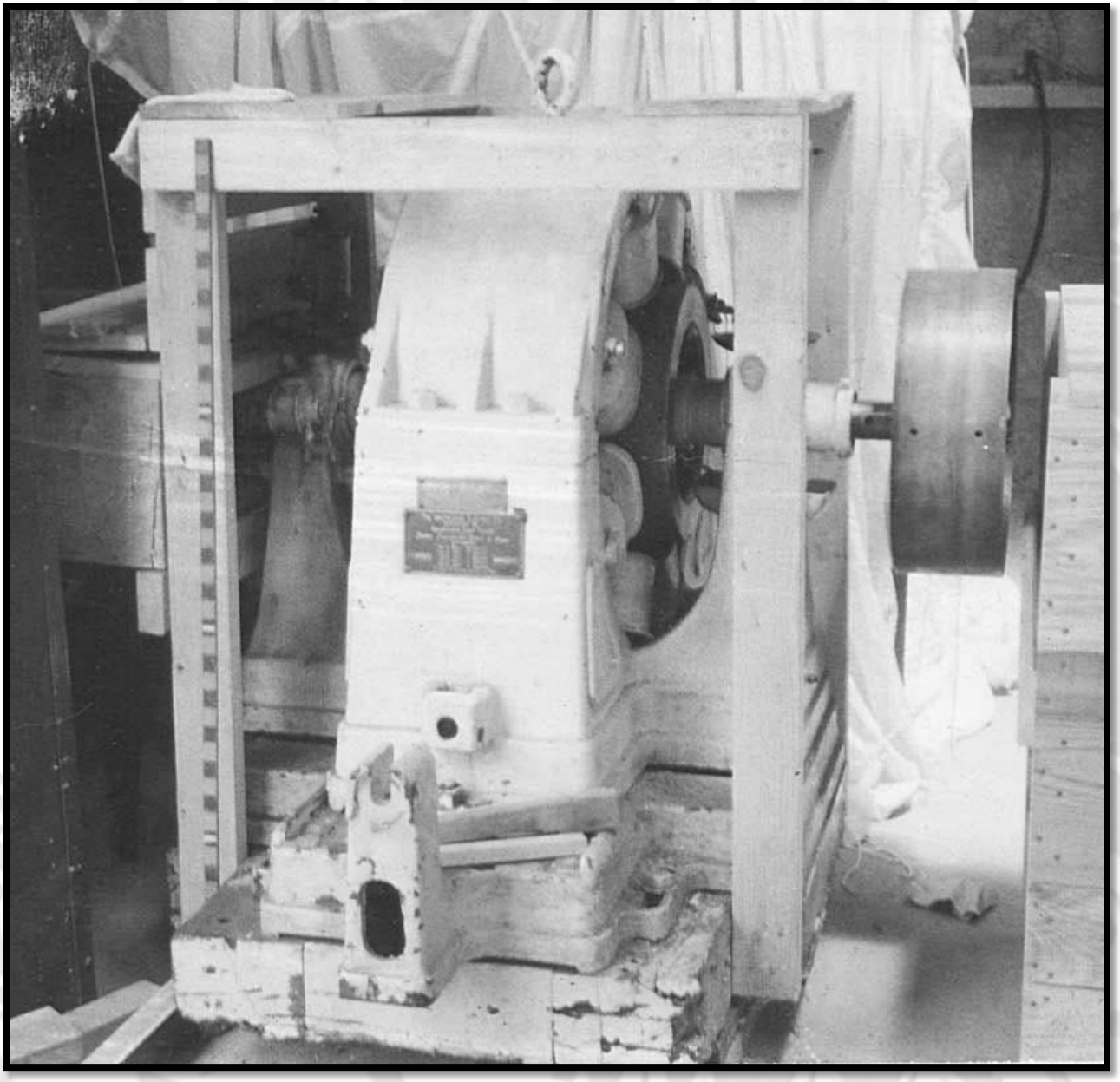
From George Westinghouse Commemoration, 1937



Henry M. Byllesby

Professor William A. Anthony

Albert I of Belgium, Richard N. Speaight - The World's Work, 1919

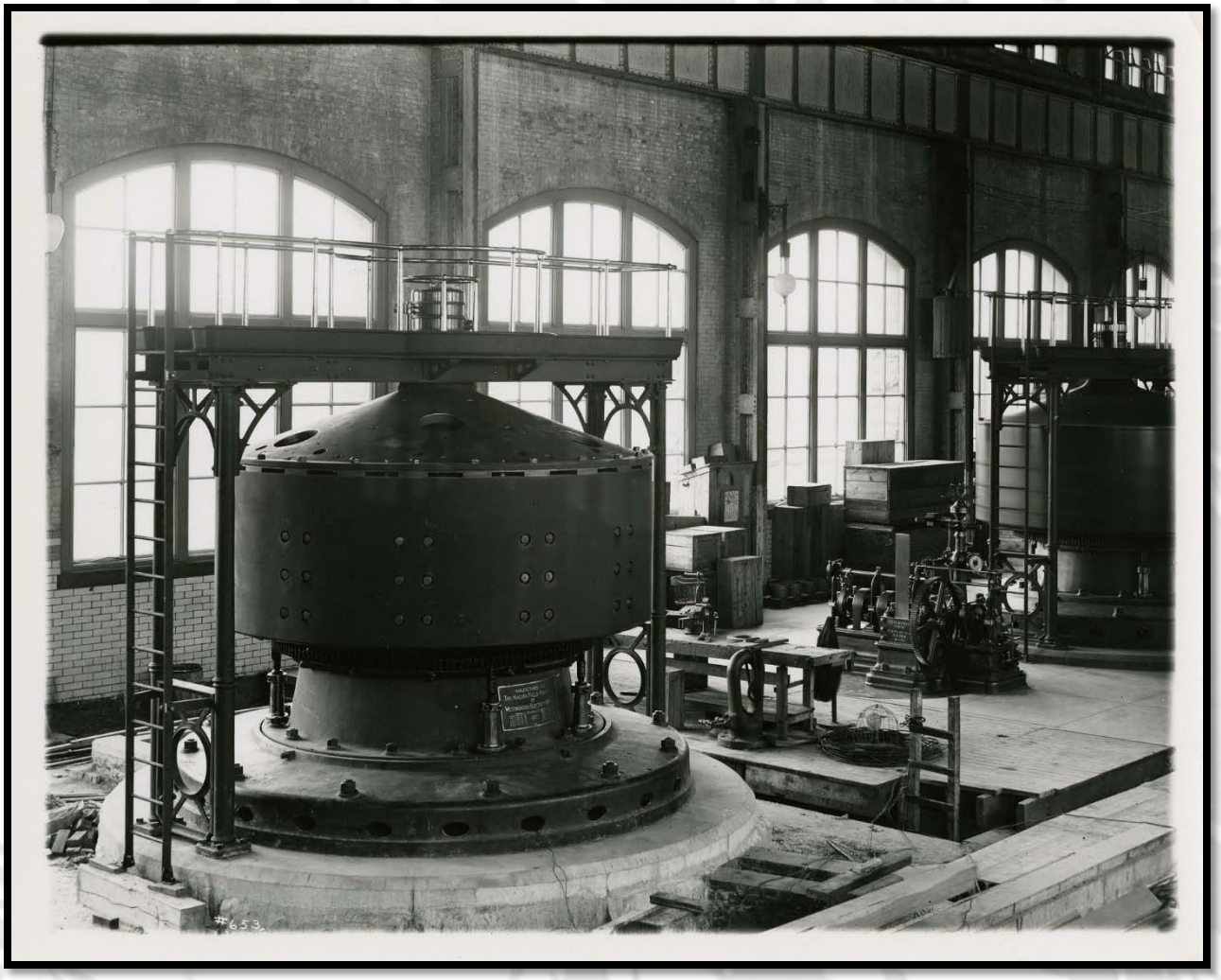


Westinghouse Electric and Manufacturing Company Single Phase AC Generator,
Smithsonian Institute, National Museum Of American History,
from Cornell University, School of Electrical Engineering thru Dean William Erickson

National Museum of American History, Kenneth M. Swezey Papers

Generators at Niagara Falls
National Museum of American History, Kenneth M. Swezey Papers

National Museum of American History, Kenneth M. Swezey Papers



Generator at Niagara Falls. Note it is not functioning in this photo as it can be seen to be stationary.
National Museum of American History, Kenneth M. Swezey Papers

William Terbo, Nikola Tesla's Grand-Nephew, gift from author's collection.

Leland I. Anderson, from Star Tribune.

Jeff Parisse of kVA Effects, Jeff Behary of Electrotherapy Museum, Carmen Miller, and John Jenkins of Spark Museum of Electrical Invention with what we believe is Nikola Tesla's earliest two-phase pre-1888 patent induction motor.

The motor would have been the catalyst for all of the activity found in this book and all subsequent events in the life and work of Nikola Tesla.

Jeff Behary, 05. November 2022

CES AGREEMENT fait ce cinquième jour

d'avril 1887, entre NIKOLA TESLA

et CHARLES F.PECK

TÉMOINETH :

ATTENDU QUE ladite TESLA prétend avoir inventé certaines améliorations des machines électriques à dynamo grâce auxquelles l'économie et l'efficacité de ces machines peuvent être considérablement augmentées. Et aussi avoir inventé un moyen ou un procédé avec un appareil approprié pour obtenir l'énergie des courants électriques à partir de la chaleur ainsi que certaines autres inventions électriques.

Désormais, dans le but de développer et de perfectionner de telles inventions et d'acquérir nos brevets à cet effet, d'introduire de telles inventions et brevets et d'en réaliser la valeur commerciale, il est convenu entre lesdites parties de ce qui suit :

Ladite TESLA consacrera son temps et ses meilleurs efforts pour achever et perfectionner ladite invention et dès qu'elle sera en état d'être brevetée, les brevets pour celle-ci seront pris au nom de ladite TESLA et de PECK en tant que cessionnaire. de TESLA.

(2). Ledit PECK avancera les sommes nécessaires à la prise des brevets

(3). Ledit PECK avancera l'argent nécessaire pour achever lesdites inventions et construire l'appareil nécessaire pour tester les mêmes inventions et brevets. Les sommes avancées par ledit PECK lui seront restituées avant que les bénéfices ne soient partagés.

Charles F.Peck

Nicolas Tesla

The Mather Electric Co.,
Manchester, Connecticut

, 31 mars 1888

N. Tesler , Esq.,

Hôtel métropolitain, New York, NY

Cher Monsieur: --

J'ai construit un petit moteur à huit pôles pour tenter l'expérience de réduire sa vitesse de moitié. Avec 16 000 alternances par minute, il tourne à environ 4 000 tours, comme je m'y attendais. Aussi, le générateur de courant alternatif, que nous installions ici dans le but de tenter quelques expériences avec vos moteurs et dont vous vous souvenez a échoué à cause de l'armature frappant les pôles, j'ai essayé l'autre jour comme moteur, prenant les courants de la même petite dynamo qui a fourni les courants dans les expériences avec vos moteurs, et elle fonctionnait bien à un tiers de la vitesse du générateur. Pour l'armature du petit moteur, j'ai fabriqué un cylindre de disques de fer et j'ai placé dessus huit bobines fermées de fil. Autrement dit, ce serait une armature à quatre pôles et, j'en suis sûr, même si je n'ai pas essayé l'expérience, fonctionnerait à la moitié de la vitesse de l'armature à deux pôles dans un champ à quatre pôles. Il me semble que dans l'adaptation de votre système aux objectifs généraux d'éclairage et de fonctionnement des moteurs et en tout cas si vous vouliez utiliser des convertisseurs sur le système à quelque fin que ce soit, il serait important pour atteindre un rendement élevé dans le convertisseurs pour obtenir des alternances très rapides, jusqu'à 15 000 ou plus par minute, et dans ce cas, cette disposition du moteur fonctionnant à une vitesse plus lente serait importante.

Il me semble que la forme de moteur que vous appelez moteur synchrone serait la meilleure pour tous les usages généraux de distribution, puisqu'il s'agit plus près de ce qu'on appelle des moteurs autorégulés du type à courant continu. L'autre moteur, qui produit un grand effort de rotation, etc., donne son grand effet lorsqu'il fonctionne à une vitesse considérablement inférieure à celle du générateur et, bien entendu, sa vitesse varie considérablement sous différentes charges ; alors que c'est exactement ce qu'il faut pour les travaux ferroviaires, l'autre bien sûr, bien que bien meilleur pour tous les cas où une vitesse constante est souhaitée.

Sincèrement vôtre,

La société Mather Electric.

Wm. A. Antoine

WM. A. ANTHONY,
électricien de Mather Electric Co., Manchester, CT.

21/IV 88

N.Tesla.

Mon cher monsieur,

Ne pouvez-vous pas préparer un document sur vos moteurs pour l'Am. Institut d'Élect. Les ingénieurs parlent parfois du

mi-mai ? Ce serait l'article le plus intéressant qui ait été présenté depuis longtemps. je vais

j'essaierai d'être là et je participerai aux discussions.

Un autre problème. Il y a quelques mois, j'ai pris rendez-vous pour donner une conférence devant la Société des Arts de

Boston le 10 mai . J'ai écrit à M. Peck il y a quelques jours pour lui demander si je pouvais décrire brièvement votre système. Le

la conférence portera sur la transmission du courant alternatif et traitera de la théorie des transformateurs et

moteurs. M. Peck écrit qu'après le 1 er mai , il n'y aura plus d'objections lors d'une conférence publique et je veux maintenant

demander une autre faveur et c'est le prêt d'un de vos moteurs, le petit format avec les deux armatures,

un pour la rotation synchrone et un pour l'effort de rotation, ainsi que le ventilateur que vous leur avez installé. Pourriez-vous laisser

je les ai à exposer à Boston le 10 mai . Le vôtre,

WA Anthony

La société télégraphique Western Union

Reçu au WESTERN UNION BUILDING, 196 Broadway, NY le 5 mai 1888

Daté : Manchester Connt .
À : M. Tesla
89 Liberty St.
NY

Il sera temps d'envoyer le moteur lundi

WA Anthony

Le Gerlach

55 West Vingt-septième St.

1er décembre 1988

Cher Monsieur Tesla

Je vous suis très reconnaissant de votre aimable lettre et vous écris plus particulièrement pour vous informer de l'état de ma santé. Comme vous le savez peut-être déjà, je suis venu en ville avec toute ma famille et nous sommes tous à l'adresse ci-dessus où nous prévoyons de rester quelques semaines.

M. Brown habite tout près et je le vois fréquemment. Peu de temps après mon arrivée en ville, j'ai attrapé un grave rhume et je n'ai pas pu quitter ma chambre depuis, mais le docteur m'assure que je me suis remis de ses effets et qu'avec précaution, je pourrai sortir à nouveau. semaine.

Je ne pense guère que les gens de Westinghouse choisiront leur option avant le 5 janvier. Nous devons faire attention à ne donner aucune excuse pour retarder au-delà de cette date – ne vaudrait-il pas mieux éviter de présenter une nouveauté à leur attention ?

Chaque nouvel appareil permettra de mieux expérimenter et nous atteindrons bientôt le 6ème mois ainsi consommé. Bien entendu, ils pourraient utiliser six ans de la même manière si nous le permettions.

Ne comprenez pas que je vous trouve des défauts, car ce n'est pas le cas. Vous avez fait un travail magnifique et j'apprécie pleinement tout votre zèle, votre industrie et votre génie.

Votre devise « Excelsior » est bonne, mais je suggère simplement qu'il serait bon maintenant de conclure l'accord actuel et que, pour ce faire, il faut mettre un terme aux expériences actuelles et n'en instituer aucune nouvelle.

Toute la famille s'unit à moi pour vous souhaiter bonne santé, prospérité et bien-être.

CF Peck

La compagnie électrique Westinghouse

Pittsburgh, Pennsylvanie, États-Unis

13 décembre 1888

M. Nicola Tesla,

Pittsburg, Pennsylvanie.

Cher Monsieur:

Conformément à la conversation d'hier soir, cette société a décidé d'accepter l'option d'achat

votre intérêt dans Tesla Electric Light & Manufacturing Co. et dans vos contrats avec cette société,

sur paiement de 950,00 $, en espèces, aujourd'hui, représentant le solde du premier paiement de 1 000,00 $ - 50,00 $

vous ayant déjà été payé, - et le solde, 4 000,00 $, à payer en espèces, le 1er février 1889, ensemble

avec deux cents actions du capital-actions de The Westinghouse Electric Company.

Votre serviteur,

La compagnie électrique Westinghouse,

H.M. Byllesby

Vice-président et directeur général

WM. A. ANTHONYÉLECTRICIEN DE MATHER ELECTRIC CO., MANCHESTER, CT.

16 janvier 1989

N.Tesla

Mon cher monsieur

Je dois vous remercier pour votre réponse très complète à ma lettre. J'ai fait des démarches pour avoir le terrain

réduit en augmentant le nombre de sections à 44 au lieu de 40. J'ai également fait retirer le

têtes de fonte de chaudière et remplissez avec des tôles retenues par des têtes comme celle-ci.

J'ai d'abord essayé la fonte et j'ai constaté qu'elle chauffait beaucoup plus que la fonte de la chaudière. J'ai remarqué un noyau nu dans

le champ et la fonte sont devenus assez chauds en une heure pour carboniser le papier collé dessus plus que la fonte écrite

a même lorsqu'il est recouvert de fil et que la machine délivre ses 250 ampères pendant des heures. Mais les têtes tordues

charbonnez un peu le papier. Je pense qu'il suffit d'en faire un conducteur à la place d'un isolant et ainsi provoquer

un grillage de l'armature. Je n'ai pas essayé le laiton comme armature complète, mais j'ai remplacé le laiton par l'un des

les têtes de fer et un noyau d'armature que j'ai fait fonctionner dans le champ excité. La conductivité du laiton n'est pas grande

différent de celui du bon fer à repasser et, en ce qui concerne les courants d'induction, doit être chauffé

à peu près pareil dans le même domaine.

Il a chauffé presque autant ce qui m'a montré que l'échauffement du fer est dû principalement à

courants d'induction et non aux frottements magnétiques. L'induction dans le fer devrait être plus grande puisque le fer de

elle-même contribue à renforcer le domaine. L'échauffement plus important de la fonte était sans aucun doute dû à l'effet magnétique.

friction. Le remplacement des deux têtes par des plaques de tôle permettra de surmonter une partie des courants d'induction,

mais ce qui me gêne c'est la grande quantité de chaleur dans le corps de l'armature tout le noyau (nu)

devient plus chaud que l'armature ne devrait le faire lorsqu'elle effectue son travail complet. Mon domaine est ce que les écrivains anglais appellent un

champ faible, il ne s'agit que d'environ 12 000 unités CGS alors que les fabricants anglais prétendent avoir travaillé avec succès

à 20 000 unités et j'ai calculé la force du champ dans le cas de plusieurs machines à partir des données

donné et trouvé 15 000 à 16 000, l'un d'entre eux avait une armature de 18" de diamètre et maintenant je pense à 800 tours.

Ils parlent tous de « charbon de fer pur » comme matériau du noyau d'armature. S'il existe une chose telle que

obtenir un fer qui ne chauffera pas dans un champ de force que j'utilise, j'aimerais le trouver.

J'ai envoyé un jeu de rondelles à boulonner là où ils ont un four de recuit très fin et je les ai fait recuire. je

Je ne sais pas depuis combien de temps ils n'ont pas été particulièrement améliorés. L'armature était à peine meilleure, voire pas du tout. Toi

diffèrent des autres en ce qui concerne l'oxyde. L'oxyde formé comme vous le décrivez est principalement l'oxyde magnétique

qui se aimante et se démagnétise difficilement, et ajoute, par le frottement magnétique, à l'échauffement.

La plupart des autorités affirment que les plaques doivent être décapées et l'oxyde retiré. J'ai fait toutes ces choses mais

mes cœurs chauffent toujours. J'ai espéré que les « Jaggers Tripple Annealed » serait mieux mais cela ne corrige pas

et j'ai dit qu'il y avait quelque chose de mieux encore, mais je ne peux pas savoir ce que c'est ni où l'obtenir.

Je sais que mon domaine n'est pas très fort car la caractéristique ne dépasse guère la ligne droite.

La machine est très sensible aux changements de vitesse ou à l'échauffement du champ. Résistance de deux ohms ajoutée à un

Un champ de 18 ohms fera baisser le potentiel de 125 à 75 volts. C'est beaucoup plus sensible que

J'aurais aimé que ce soit le cas.

J'aimerais pouvoir surmonter l'échauffement du noyau car je veux maintenir la résistance d'armature basse,

mais je ne vois pas comment le faire tant que je n'aurai pas trouvé un meilleur fer.

Bien cordialement, fidèlement à vous,

Wm. A. Antoine

WM. A. ANTHONY
ÉLECTRICIEN À MATHER ELECTRIC CO., MANCHESTER, CT.

N.Tesla

Mon cher monsieur

J'ai des ennuis et je vous écris pour obtenir de l'aide. J'ai conçu une nouvelle machine pour utiliser un moteur beaucoup plus puissant

champ que l'ancien. – J'ai un noyau d'armature de 12" de diamètre, 15" de long, et avec 40 bobines, un tour chacune

125V à 800 tours. Mais le noyau chauffe excessivement. Les plaques sont en tôle n°28 de Laufman Apollo

Penn. Ils sont isolés du fût par de fines fibres cimentées et tournées vers l'extérieur. Il y a du papier de soie

entre eux et une assiette sur cinq, un morceau de papier épais. Une magnéto ne sonnera jamais à travers les tissus

sur le papier épais. Le noyau est maintenu ensemble par des plaques d'extrémité en fer à bride de qualité supérieure vissées.

l'arbre. Ces plaques ont une finition d'environ 7/16" d'épaisseur. Ils chauffent beaucoup plus que le corps de l'armature.

Sur celui qui a brûlé l'autre jour, le papier en contact avec cette plaque a noirci et brûlé

entre la tôle sur un demi-pouce des plaques d'extrémité au-delà de ce point, elle n'était pas décolorée.

Il n'y a aucun boulon à travers le noyau. Une plaque de laiton chauffe presque autant que le fer.

Pouvez-vous suggérer un remède ? J'ai commandé du fer Jaggers triple recuit n° 30 importé mais

Je ne l'ai pas reçu. J'ai entendu dire qu'il existe un meilleur fer à repasser, pouvez-vous me dire quoi et où l'obtenir ?

À vous en toute hâte,

WA Anthony

*Note de l'auteur : Le fer spécial qu'il recherchait était le secret de l'efficacité du transformateur Westinghouse, « l'acier Bessimer », dans lequel de l'oxygène était utilisé dans le processus de fabrication pour éliminer les impuretés, en particulier le carbone.

Société d'électricité et de fabrication Westinghouse

Pittsburgh, Pennsylvanie, États-Unis, 22 juin 1891

M. Nicola Tesla.

Mon cher monsieur:

Ci-joint, je vous envoie une coupure du Pittsburgh Dispatch, qui intéressera sans aucun doute

toi. Lorsque vous parcourez l'article, vous constaterez que j'avais raison lorsque j'ai déclaré dans le journal quelques années

il y a quelques années, vous gagniez rapidement une réputation à l'échelle de l'hémisphère comme l'un des plus grands inventeurs de l'électricité

de notre époque.

Votre serviteur,

Ernest H. Heinrichs

Société d'électricité et de fabrication Westinghouse,

Pittsburg, Pennsylvanie.

27 janvier 1893

M. N. Tesla,

Le Gerlach,

27 e rue, New York.

Cher M. Tesla : -

Votre précieuse faveur du 23 est reçue. Je recevrai un exemplaire du « London Electrical Review » de

13 janvier 1893, et accordez à la question l'attention voulue comme vous le suggérez.

En vous remerciant, je reste,

Votre serviteur,

Lemuel Bannister

Vice- Premier . & Directeur Général

Non. _____

Pittsburgh, Pennsylvanie, 30 avril 1893
N. Tesla. N° de commande d'Esq WE & M. Co._____N° de commande de l'acheteur de New York_____

Rachat de Westinghouse Electric & Manufacturing Company.
Termes. _____

1892				
Fév	9	1 – Moteur Tesla selon les spécifications		
		exper meublé .	200,00	200,00
Déc	12	Armature de moteur à courant alternatif 1 à 24 pôles exper .	25h00	25h00
Jan	5	3 – Anneaux de tôle N. Tesla	5h00	5h00
Mar	3	2 – Aimants laminés NT	70.00	70.00
"	18	2 – 11 2 S IP Moteur Tesla 75,00	150,00	
"		2 – 1 « Tesla El. Co.	107.00	
"		1 - « 0 WC Excitateur Expérience	125,00	382,00
"	21	1 - Moteur E 500 Volts		
		1 – Poulie		
		1 – Fusible		
		NT { moins 30% / moins 10%	168.00 50.40 117.6011.76	105,84
				784.84

WA ANTHONY,
MANCHESTER, CONN.

26 septembre 1993

M. Nikola Tesla,

Mon cher monsieur,

Merci pour la copie de votre conférence reçue hier. Je suis très heureux de l'avoir sous cette forme car, même si je l'avais lu tel qu'il apparaît dans les revues électriques, ce n'est pas une forme de référence très pratique et une conférence comme la vôtre n'est pas du genre à être lue et mise de côté. Vos illustrations des relations entre capacité et auto-induction et fréquence de vibration sont nouvelles et très frappantes et font ressortir de manière très claire des résultats très intéressants. J'ai relu le journal avec grand plaisir.

Vous connaissez mon habitude controversée et ma tendance à prendre « l'autre » côté d'une question, parfois simplement pour le plaisir d'argumenter, et je voudrais également suggérer une question sur l'effet de ces décharges à haute fréquence sur l'organisme humain.

Vous montrez que la main peut s'approcher si près qu'elle reçoit la décharge de la brosse sans aucune souffrance ni inconvénient, et remarquez qu'une quantité bien moindre d'énergie appliquée au corps sous forme de courants basse fréquence ou continus entraînerait la mort. Quelle quantité d'énergie votre corps dépense-t-il lorsque vous prenez cette décharge en brosse ? Vous déclarez que la PD de votre bobine est d'environ 200 000 volts. Quelle quantité de courant transférez-vous à cette pression ? 1/100 ampères signifierait 2 000 watts ou 2 2/3 HP. Votre générateur, lorsque vous exécutez ces effets, produit-il plus que cela ?

Si le courant ne dépasse pas 1/100 ampères et que la résistance du corps est de 2 000 ohms, il n'aura besoin que de 20 volts pour le maintenir et le reste de vos 200 000 volts est dépensé dans l'air à travers lequel la décharge doit bondir pour atteindre votre main.

Mais en supposant que le courant soit de 1/10 ampère, auquel cas une charge de 30 CV serait projetée sur votre générateur à chaque fois qu'une décharge aurait lieu, votre corps ne dépenserait toujours que 200 000 volts x 1/10 ampère ou 20 watts. , le reste des 20 000 watts étant dépensé dans l'air. Comment cela vous frappe-t-il ?

Fidèlement votre,

WA Anthony

Westinghouse Electric & Manufacturing Company

Pittsburg, Pennsylvanie.

Salle 27, bâtiment Westinghouse,

13 mars 1895

M. Nikola Tesla,

Hôtel Gerlach,

New York, New York

Mon cher monsieur: --

Remarquant par les journaux d'aujourd'hui que vous avez subi de graves pertes suite à l'incendie de votre usine de South Fifth Avenue,

Je m'empresse de vous présenter mes plus sincères regrets et j'espère que vous étiez bien assuré et que vous pourrez bientôt retrouver

un autre endroit approprié pour poursuivre votre travail.

Sincèrement vôtre,

Ernest H. Heinrich

Le Gerlach

New York, le 22 mars 1895

M. Albert Schmid,

Pittsburgh, Pennsylvanie.

Mon cher M. Schmid : -

Vous avez sans doute appris grâce aux journaux du

malheureux accident qui m'a privé de tout mon appareil, et de quelques résultats de mes récents travaux. je

Je dois maintenant reconstruire mon laboratoire et j'aurai besoin de quelques machines. J'écrirai une lettre au

Westinghouse Company à ce sujet après avoir consulté M. Adams. Vous m'obligerez grandement si vous le faites

ce qui est en votre pouvoir pour expédier ce qui est demandé dans les plus brefs délais,

En vous remerciant d'avance, je suis

Cordialement,

Le Gerlach,

New York, 27 mars 1895

M. Albert Schmid,

Pittsburgh, Pennsylvanie.

Mon cher M. Schmid,

Vous vous souviendrez qu'il y a quelque temps je vous ai écrit

que j'allais vouloir certaines de vos bandes de fer de convertisseur recuites. J'ai maintenant décidé quant à leur

taille. Ils doivent mesurer deux pouces et cinq huit (2 5/8) de largeur et onze pouces et cinq huit (11 5/8) pouces.

long. Concernant l'épaisseur, merci d'utiliser la même que sur vos convertisseurs jugée la plus pratique à considérer

performance et coût, etc.

Je vous assure que ces bandes seront facilement obtenues sans trop de retard, et comme elles seront

poinçonnés, ils seront de taille uniforme. Vous ajouterez à mes obligations si vous avez la bonté de veiller à ce que ces

les bandes sont de la meilleure qualité de fer (ou d'acier) et recuites avec le plus grand soin, car expédiées avec le moins

retard possible à mon adresse ci-dessus. Je veux assez de ces bandes pour constituer un poids de mille

(1000) livres.

Veuillez me faire savoir dès réception de cette lettre quand je pourrai recevoir ces bandes. Comme le temps est

en pressant je vous prie de les faire parvenir par express à mes frais.

En espérant que vous m'obligerez à vous occuper de cette affaire immédiatement, je suis sincèrement à vous,

Le Gerlach,

New York, 30 mars 1895

M. Albert Schmid,

Pittsburgh, Pennsylvanie.

Mon cher M. Schmid : -

Je dois vous remercier pour votre aimable lettre

du 27 mars . Je pourrai peut-être sortir et discuter avec M. Bannister.

L'autre jour, je vous ai écrit à propos de bandes d'acier de convertisseur recuit, et je suis toujours anxieux

en attente de votre réponse. En espérant que vous avez commandé le matériel, et que je l'obtiendrai sans trop tarder

retard, je suis

Cordialement,

Le Gerlach

New York, 30 mars 1895

M. Albert Schmid,

Pittsburgh Pennsylvanie.

Mon cher M. Schmid : -

Faites-moi signe et faites-moi savoir, dès réception de ceci, ce qui est

le plus petit transformateur biphasé rotatif que vous ayez en stock. J'aimerais avoir environ 25 cycles par jour

deuxièmement, tel qu'adopté à Niagara. Le collecteur doit être doté d'un grand nombre de barres, donc

que je peux obtenir un courant continu dont je veux à certaines fins en laboratoire.

Je préférerais une telle machine à une machine qui ne comporte que peu de segments de collecteur et dans laquelle le

courant en nécessairement ondulant.

Je propose d'utiliser une machine de la description ci-dessus et d'une capacité d'environ 25 CV environ, pour

des moteurs d'entraînement et le peu de machines dont je veux dans le département électrique de mon atelier. J'ai

j'ai fourni de la vapeur pour mon atelier.

Vous augmenterez mes obligations si vous me faites savoir avec quels moteurs je pourrais aller avec

cette machine.

La tension doit être comprise entre 125 volts et 220 volts maximum. De plus, je ne suis pas

limité exactement à la capacité, et cela pourrait être quelque chose de plus de 25 CV, mais pas beaucoup plus.

En espérant recevoir de votre part une réponse rapide et favorable, et vous remerciant par avance, je suis

Cordialement ,

Le Gerlach

New York, 1er avril 1895

M. Albert Schmid,

Pittsburgh, Pennsylvanie.

Mon cher M. Schmid : -

Votre lettre du 28 mars reçue . Je suis très obligé pour votre

la gentillesse de s'occuper de l'affaire immédiatement, et je vous rappellerais seulement de ne pas envoyer les bandes par fret,

mais par express à mes frais, et merci de m'informer également de l'envoi de l'envoi.

Cordialement,

Le Gerlach,

New York, 3 avril 1895

M. Albert Schmid,

Pittsburgh, Pennsylvanie.

Mon cher M. Schmid : -

Un grand merci pour votre aimable lettre. j'ai décidé d'acheter

une machine du genre dont vous parlez. J'ai écrit une lettre à M. Bannister et je vous en supplie, s'il vous plaît

conférer avec lui sans délai. Je peux vous assurer que je serai reconnaissant pour votre aide. La machine

devrait être enroulé pour 220 volts et devrait donner 3200 alternances par minute, et je le ferai plus tard

les moteurs étaient également enroulés pour 230 volts. À propos de ces moteurs, j'écrirai plus tard, car je pense qu'il y aurait

ne tardez pas beaucoup à les obtenir. La capacité de la machine x devrait être d'environ 30 CV, mais peut

avoir 25 ans si vous le souhaitez, et il est très important pour moi de l'avoir le plus tôt possible, car une grande partie de mon travail est

retardé. Comme j'ai l'intention d'utiliser cette machine à certaines fins spécifiques en relation avec mes oscillateurs, un

le chiffre de haute efficacité est un élément important. S'il vous plaît, n'épargnez donc aucune peine ni aucune dépense pour

garantir le meilleur résultat. Je m'en remettrai, quant au prix, entièrement à l'équité du Westinghouse.

Entreprise. Je crois qu'il y a des messieurs dans cette entreprise qui croient en un au-delà.

Vous mentionnez dans votre lettre qu'il lui faudrait six semaines pour fournir la machine. Si tu trouves

quel que soit le moyen de raccourcir cela en sélectionnant des modèles existants, je vous serais très reconnaissant de le faire.

Mais je voudrais, comme je l'ai déjà dit, le meilleur travail et les meilleurs résultats qui soient dans les limites de la

portée de vos capacités et de votre expérience.

Veuillez me dire si cela est compris et si vous poursuivez les travaux.

Cordialement, je suis

Cordialement,

Le Gerlach,

New Yok City, 4 avril 1895

M. Albert Schmid,

Pittsburgh, Pennsylvanie.

Mon cher M. Schmid : -

Je viens de recevoir une dépêche m'informant de l'envoi de 412 livres de bandes de fer, comme commandé. Veuillez accepter mes meilleurs remerciements pour votre gentillesse en vous occupant de ce petit affaire.

Cordialement,

Le Gerlach,

New York, 6 avril 1895

M. Albert Schmid,

Pittsburgh, Pennsylvanie.

Mon cher M. Schmid : -

Votre dépêche d'hier, relative aux convertisseurs haute tension, reçu. Je vous écrirai à ce sujet lundi, car je dois vous proposer quelques améliorations sur le convertisseurs que vous avez déjà réalisés. Celles-ci n’entraîneront cependant aucune perte de temps.

En vous remerciant de l'attention que vous porterez à votre réponse, je suis

Cordialement,

Société d'électricité et de fabrication Westinghouse

120-Broadway

NEW YORK, NY, 8 avril 1895

Nikola Tesla, Esq.,

Le Gerlach,

La ville de New York.

Cher M. Tesla :

Je reçois aujourd'hui notre lettre du 3 e inst. Et j'ai demandé à Pittsburgh préparer et expédier le transformateur biphasé rotatif décrit par M. Schmid. La commande recevra notre meilleure attention, et lorsque j'aurai les données, cela me fera plaisir de rendre le prix aussi bas que possible.

peut-être.

J'ai regretté chaque fois que j'ai pensé à ton malheur qui aurait dû rencontrer une telle perte. Je suis très heureux de savoir que vous avez pris votre manteau et que vous êtes retourné au travail pour tout remettre en place.

forme dans les plus brefs délais.

Je compte être à New York plusieurs jours et j'espère avoir le plaisir de vous voir.

Votre serviteur,

Lemuel Bannister

Vice-président et directeur général.

Le Gerlach,

New York, 9 avril 1895

M. Albert Schmid,

Pittsburgh, Pennsylvanie.

Mon cher M. Schmid : -

Votre dépêche, m'informant de l'expédition du solde du fer

bandes, reçues. J'ai également reçu une lettre de M. Bannister, dans laquelle il m'informe que l'ordre

pour le transformateur rotatif est passé par l'atelier. Vous m'obligerez grandement si vous poussez le travail

sur ce transformateur, et le rendre excellent à tous points de vue, car il est probable que je l'exposerai en relation avec

avec mes oscillateurs.

M. Stillwell m'a dit l'autre jour que vous aviez expédié à mon adresse deux anneaux à champ tournant

qui ont été exposés à l'Exposition universelle. J'ai très hâte de les obtenir, mais comme je ne l'ai pas encore fait,

reçu quelque chose, j'ai peur qu'ils soient quelque part à la gare. Veuillez examiner le

matière et les tracer.

En vous remerciant encore, je suis

Cordialement,

46, rue E. Houston,

New York, 12 avril 1895

Westinghouse Electric Co.,

Pittsburgh, Pennsylvanie.

Messieurs: -

Les bandes de fer que vous avez envoyées ont été reçues. Je te remercie pour ton

livraison rapide et je vous prie de nous envoyer la facture bientôt.

Sincèrement votre,

46, rue E. Houston,

New York, 12 avril 1895

MWC Clark,

Pittsburgh, Pennsylvanie.

Mon cher monsieur: -

Votre faveur du 10 avril est reçue. Je vous remercie beaucoup pour votre gentillesse

m'écrire et m'occuper de l'affaire.

Sincèrement votre,

N.Tesla

La ville de New York,

46, E. Houston St., 13 avril 1895 .

Westinghouse Electric Co.,

Pittsburgh, Pennsylvanie.

Messieurs: -

Veuillez nous faire parvenir, dans les plus brefs délais, trois petits moteurs à courant continu,

à savoir, un HP, un demi HP et un quart HP. Les trois moteurs doivent être enroulés pour un circuit de 220 volts.

En espérant que vous me favoriserez avec une expédition rapide de cet appareil, je suis

Sincèrement votre,

46, rue E. Houston,

New York, 13 avril 1895

M. Albert Schmid,

Pittsburgh, Pennsylvanie.

Mon cher M. Schmid : -

On vient de m'écrire à la Westinghouse Company au sujet de trois petits moteurs à courant continu, à savoir un HP, un demi HP et un quart HP, tous enroulés pour 220 volts.

S'il vous plaît, faites-moi plaisir et donnez-moi ces documents immédiatement, car j'en ai temporairement besoin dans le magasin où je ne disposent actuellement que du courant continu de la gare centrale.

Cordialement,

46, rue E. Houston,

New York, le 13 avril 1895 .

M. George Westinghouse, Jr.,

Nouvelle ville de Youk .

Cher M. Westinghouse : -

Depuis quelques temps, mon ami Hubert Vos, le grand portrait

Le peintre a séjourné dans cette ville. Je lui ai très souvent parlé de vous et je sens qu'il

a une idée de votre personnalité telle qu'elle lui permettrait de faire de vous un portrait qui serait un

ajout précieux à l'art.

Je suppose que, sous la pression de vos nombreux engagements, vous n'avez pas encore trouvé de moments de

vous avez le loisir de vous consacrer à un tel objectif et, pensant que vous pourriez sentir que c'est dans une certaine mesure votre

devoir de le faire, j'attire votre attention sur cette opportunité favorable.

Sincèrement votre,

La ville de New York,

46, E. Houston St., 16 avril 1895

Westinghouse Electric Co.,

Pittsburgh, Pennsylvanie.

Messieurs: -

J'accuse réception de votre faveur du 15 avril et tiens à remercier vous pour votre réponse rapide.

Comme vous n'avez pas de petits moteurs, je devrai me contenter de ce que vous pourrez me fournir. S'il te plaît faire avancer , le plus tôt possible, un moteur d' une CV, 1900 tours, bobiné pour circuit 220 volts, et un Moteur ¾ HP pour le même circuit et 1300 tours par minute.

Je sous-entends que le dernier moteur est en réalité un moteur d'un HP déguisé, et j'espère que ces deux les moteurs seront suffisants pour mes besoins actuels.

Veuillez m'obliger par une livraison rapide.

En vous remerciant d'avance, je suis

Sincèrement votre,

46, rue E. Houston,

New York, 20 avril 1895

Westinghouse Electric Co.,

Pittsburgh, Pennsylvanie.

Messieurs: -

Je vous prie d'accuser réception des deux anneaux à champ tournant qui ont été exposé à l'Exposition universelle. Veuillez accepter mes meilleurs remerciements pour votre gentillesse en m'offrant ceci

appareil, auquel j'attache maintenant une valeur particulière, puisque la plupart des objets qui m'étaient chers ont

été détruit.

Sincèrement votre,

46, rue E. Houston,

New York, 23 avril 1895

M. Albert Schmid,

Pittsburgh, Pennsylvanie.

Mon cher M. Schmid : -

Vous vous souviendrez qu'il y a quelque temps je vous ai écrit à propos de convertisseurs haute tension dont j'avais besoin pour poursuivre mes investigations, les anciens ayant été détruits.

En recevant les convertisseurs haute tension de l'Exposition universelle, j'ai constaté que l'un d'eux était blessé. J'ai alors été obligé de le démonter et de le réparer, et à cette occasion j'ai constaté certains défauts auxquels j'ai essayé de remédier dans le dessin que je vous ai envoyé aujourd'hui par la poste.

Je ne doute pas que le dessin sera suffisamment clair pour que vous puissiez sauvegarder toute la description. Je voudrais seulement remarquer que pour constituer les bobines secondaires, j'ai supposé que vous utiliseriez des rondelles de fibres rivetées entre elles par de petits rivets en laiton. Je suppose que vous pouvez fabriquer ces rondelles en petits morceaux, afin de ne pas nécessiter le découpage de grandes feuilles de fibres, mais je ne veux pas que vous épargniez quelques dollars sur mon compte. Au centre du noyau de fer, j'ai trouvé indispensable de mettre un boulon en laiton comme indiqué sur le dessin, et en outre de placer des bandes de fer devant les extrémités du noyau. Ces bandes dont j'ai besoin pour plusieurs raisons.

Je vous prie de demander à M. Kaiser d'enrouler ces secondaires avec le plus grand soin et d'essayer de placer exactement 100 tours de fil n°26 sur chaque couche. Aux extrémités de chaque couche, enroulez une ficelle d'un diamètre légèrement plus grand que le fil isolé, de sorte que le papier placé entre les couches aura tendance à gonfler aux extrémités. J'ai calculé que ce papier avait une épaisseur de près de 1/64 de pouce.

Les extrémités du secondaire doivent se terminer comme indiqué en a et b. Bien sûr, je compte que vous mettrez moins de tours sur la dernière couche, puis enroulerez du fil épais et toronné sur le dessus pour protéger le fil le plus fin.

Chaque moitié du primaire aura quatre extrémités, car le bobinage est constitué de deux fils isolés l'un de l'autre. Il devrait donc y avoir huit bornes pour la primaire.

S'il vous plaît, obligez-moi par une réponse si tout est compris, et commencez le travail sans délai.

Je vous serai très reconnaissant de votre attention personnelle et de tous services qui pourraient me rendre à cet égard.

Très sincèrement vôtre,

46, rue E. Houston,

New York, 24 avril 1895

M. Albert Schmid,

Pittsburgh, Pennsylvanie.

Mon cher M. Schmid : -

En vous écrivant hier à propos du convertisseur haute tension, je j'ai oublié de préciser que je préférerais placer le tank en fer, qui doit être très solide, sur un petit camion aménagé à cet effet, de manière à pouvoir être facilement déplacé.

Vous n'avez pas besoin de recouvrir le réservoir de fer avec les planches, comme vous le faisiez sur l'ancien appareil, car cela simplement augmente le poids et le coût.

Sur le côté, j'ai montré le bois, qui doit bien sûr être le bois à motif le plus sec, en le remplissant comme laisser autant d'espace que possible autour de la batterie, afin de réduire au minimum la quantité d'huile. En plus l'économie présente l'avantage que la bobine est plus légère et plus sûre. Veuillez donc demander au menuisier couper les morceaux de manière à s'adapter partout autour des bobines à une distance d'environ ¾ de pouce, ce que j'ai considérer le minimum. Vous pouvez également placer une planche entre les deux bobines secondaires à une distance de ¾ de à un pouce de chacun.

N'oubliez pas également que lors du bobinage du secondaire, je n'utiliserais en aucun cas de la gomme-laque ou tout autre vernis, mais un peu d'huile légère, comme de l'huile de paraffine, qui sera appliquée sur chaque couche quand ce sera fini. N'utilisez pas d'huile de lin , car la bobine pourrait chauffer pendant le bobinage.

Vous m'obligerez grandement si vous m'envoyez une dépêche dès réception de ceci, que vous avez mon croquis et que vous continuez les travaux.

En espérant avoir de vos nouvelles prochainement également concernant le transformateur rotatif que j'ai commandé, nouvelle favorable, je suis

Cordialement à vous,

46, rue E. Houston,

New York, 25 avril 1895

MCF Scott,

Pittsburgh, Pennsylvanie.

Mon cher M. Scott : -

J'ai écrit à la Westinghouse Company au sujet d'un problème de haute tension

convertisseur de conception quelque peu modifiée, destiné à remplacer les anciens convertisseurs construits

pour l'Exposition universelle.

Même si je sais que M. Schmid fera pour moi tout ce qu'il peut, mais craignant qu'il ne soit

trop occupé, ou loin de l'usine, j'écris ceci pour vous demander si vous ne voudriez pas bien vouloir consacrer un peu d'attention à

cette petite affaire. Je vous serais très obligé si vous veillez à ce que j'obtienne au moins un des deux

convertisseurs très bientôt. J'espère également que vous pourrez faire avancer la construction du système tournant

transformateur que j'ai commandé il y a quelque temps. Mon travail a été soudainement interrompu alors que j'étais à

l'étape la plus intéressante du développement de certaines idées, et j'ai vraiment besoin de mon appareil pour

recommencer le travail.

En vous remerciant d'avance pour tout service à cet égard, je suis

Cordialement,

46, rue E. Houston,

New York, 26 avril 1895 .

M. Albert Schmid,

Pittsburgh, Pennsylvanie.

Mon cher M. Schmid : -

Votre dépêche d'hier reçue.

Veuillez accepter mes remerciements pour votre action rapide. J'espère que la construction du tournant

le transformateur progresse favorablement.

Cordialement,

46, rue E. Houston,

New York, le 3 mai 1895 .

Westinghouse Electric Co.,

Pittsburgh, Pennsylvanie.

Messieurs: -

Je souhaite accuser réception des marchandises selon le relevé qui m'a été transmis

avec votre faveur du 30 avril , à savoir, un moteur shunt de 1 CV, moteur de 220 volts ; Un shunt ¾ HP

Moteur enroulé, avec glissières de tendeur de courroie, deux rhéostats et une poulie.

Les plans montrant les schémas de connexions ont également été reçus sous pli séparé.

Merci pour la livraison rapide, je suis

Sincèrement votre,

46, rue E. Houston,

New York, 3 mai 1895 .

M. Albert Schmid,

Pittsburgh, Pennsylvanie.

Mon cher M. Schmid : -

Je vous serais très reconnaissant de bien vouloir me faire savoir comment se déroulent les travaux sur le

le transformateur rotatif progresse et quand comptez-vous pouvoir l'expédier.

Très sincèrement vôtre,

46, rue E. Houston,

New York, le 4 mai 1895 .

MCF Scott,

Pittsburgh, Pennsylvanie.

Mon cher M. Scott : -

Merci pour votre lettre du 3 mai que je viens de recevoir.

Je n'ai guère besoin de vous assurer à nouveau, à cette occasion, que je serai très obligé pour tout problème

vous prenez à avancer les travaux sur mon appareil.

Je suis particulièrement inquiet au sujet du transformateur tournant, car je n'ai plus rien entendu depuis

quelque temps à ce sujet.

Sincèrement vôtre,

46, rue E. Houston,

New York, le 9 mai 1895 .

MCF Scott,

Pittsburgh, Pennsylvanie.

Cher M. Scott : -

Merci pour le rapport favorable concernant le transformateur rotatif. je ne vous dérangerait pas avec cette question sachant que vous faites tout ce qui est en votre pouvoir pour faire avancer le travail,

n'était-ce pas que j'ai si hâte de recommencer mes expériences interrompues. Ce genre de travail est presque indispensable à ma santé, et j'espère que sa reprise aura sur moi un bon effet.

Cordialement,

46, rue E. Houston,

New York, le 9 mai 1895

Compagnie électrique Westinghouse,

Pittsburgh, Pennsylvanie,

M. Albert Schmid, surint.

Cher M. Schmid: -

Lorsque j'ai commandé le transformateur rotatif de 30 CV, j'ai laissé entendre qu'un boîtier de démarrage l'accompagnerait.

Je n'ai pas, dans mon laboratoire, le courant continu du réseau municipal, et j'aurai besoin d'un boîtier pour

démarrer le transformateur. Vous pouvez avoir une boîte prête, et si ce n'est pas le cas, veuillez en faire fabriquer une à cet effet, et

expédié avec le transformateur ou avant.

Sincèrement votre,

46, rue E. Houston,

New York, le 14 mai 1895

MCF Scott, électricien,

Westinghouse Electric Co.,

Pittsburgh, Pennsylvanie.

Cher Monsieur: -

Votre faveur du 11 mai vient d'être reçue. Je sais que vous avez une vaste expérience

dans des affaires apparentées, et que vous emploierez la meilleure méthode pour faire sortir les terminaux.

Je suggérerais, en raison de la commodité que j'aurais, que vous mettiez en tête des

bornes de liaison pour le fil primaire comme pour le fil secondaire, de manière à me permettre d'attacher, même au dernier, un

fil très lourd. Les colonnes en caoutchouc, au sommet desquelles sont placées les bornes de liaison secondaires,

doivent être amovibles, afin de ne pas gêner l'emballage en cas d'expédition. Le meilleur

Une autre méthode, me semble-t-il, serait de connecter le fil secondaire le plus profondément possible dans le réservoir à deux

des blocs métalliques, dans lesquels seraient vissées des tiges métalliques recouvertes de caoutchouc dur.

Je dois en outre suggérer que le réservoir soit placé sur un petit camion à rouleaux, et là

il y aura de chaque côté des poignées en fer ordinaires pour éventuellement soulever l'ensemble.

En espérant que je recevrai bientôt la bobine, et en vous remerciant pour votre attention et votre peine.

le problème, je suis

Sincèrement votre,

46, rue E. Houston,

New York, le 14 mai 1895

M. Albert Schmid, surintendant,

Westinghouse Electric Co.,

Pittsburgh, Pennsylvanie.

Mon cher M. Schmid : -

Ceci vous présentera, M. Johann Jordan, de Vienne, qui désire pour exploiter ici quelques charbons améliorés de sa propre fabrication, et pour d'autres affaires, avec le en vue d'importer en Europe des machines ou des articles américains.

Toute courtoisie et tout service que vous pourrez rendre à M. Jordan seront appréciés par moi.

Cordialement,

46 , rue E. Houston,

New York, le 15 mai 1895 .

MWC Clark, assistant. Directeur général,

Westinghouse Electric Co.,

Pittsburgh, Pennsylvanie.

Cher Monsieur: -

De votre faveur du 14 mai , que je viens de recevoir, je déduis que M. Bannister est absent,

et je me permets de vous écrire et de vous dire qu'à mon avis le capitaine de Khotinsky serait un très ajout précieux à votre personnel, surtout si la société Westinghouse est engagée dans un accumulateur ou des travaux électrolytiques, car il possède une vaste expérience dans ce domaine.

Sincèrement votre,

N Tesla

46, rue E. Houston,

New York, le 16 mai 1895 .

MWJ Longmore,

Westinghouse Electric Co.,

La ville de New York.

Mon cher monsieur: -

Ceci vous présentera, M. Francis Jehl , que je connais depuis de nombreuses années. je

J'ai une haute opinion de l'intégrité de M. Jehl dans ses relations commerciales et je suis convaincu que, quoi qu'il en soit,

arrangez-vous avec vous, vous n’avez aucune raison de le regretter.

Sincèrement votre,

46, rue E. Houston,

New York, le 17 mai 1895 .

M. Albert Schmid, surintendant,

Westinghouse Electric Co.,

Pittsburgh, Pennsylvanie.

Mon cher M. Schmid : -

J'ai reçu votre faveur avant hier, et je vous prie, en

construire le rhéostat, pour permettre une grande capacité de fil, car j'aimerais me procurer une boîte de résistance qui

non seulement serait pratique pour démarrer le transformateur rotatif, mais pourrait également être utilisé pour d'autres

et en cas d'urgence, j'aimerais disposer d'une gamme aussi large que possible.

En espérant que vous pourrez bientôt expédier la machine et l'appareil commandés, je suis

Cordialement,

46, rue E. Houston,

New York, le 18 mai 1895 .

MCA Bragg,

Westinghouse Electric Co.,

Philadelphie, Pennsylvanie.

Mon cher M. Bragg : -

Votre lettre avec pièce jointe reçue. J'ai maintenant une foi plus grande que jamais

en votre honnêteté, car les enclos étaient constitués d'obligations d'État.

Je me trouve à l'adresse ci-dessus et je serai ravi de vous voir à tout moment.

Sincèrement votre,

46, rue E. Houston,

New York, 21 mai 1895.

M. Albert Schmid,

Westinghouse Electric Co.,

Pittsburgh, Pennsylvanie.

Mon cher M. Schmid : -

Votre dépêche vient de recevoir. Je suis très reconnaissant pour votre gentillesse et

j'espère qu'il n'y aura pas de retard imprévu dans l'expédition.

Cordialement,

46, rue E. Houston,

New York, 22 mai 1895.

M. Albert Schmid,

Westinghouse Electric Co.,

Pittsburgh, Pennsylvanie.

Mon cher M. Schmid : -

Veuillez poster, le plus tôt possible, dès réception de cette lettre, le bleu-impressions du transformateur à champ tournant, car je souhaite les dimensions de la base.

Obligez-moi par une réponse sans délai.

Cordialement,

46, rue E. Houston,

New York, 28 mai 1895.

M. Albert Schmid,

Westinghouse Electric Co.,

Pittsburgh, Pennsylvanie.

Mon cher M. Schmid : -

Merci pour le plan de la fondation de mon transformateur rotatif que je viens de recevoir avec votre lettre du 24 mai .

J'espère que vous pourrez expédier la machine, comme promis dans votre dernière lettre. J'anticipe aussi l'expédition du transformateur haute tension très prochainement.

Avec mes remerciements pour votre gentillesse, je suis

Cordialement,

46, rue E. Houston,

New York, 29 mai 1895.

M. Albert Schmid, surintendant,

Westinghouse Electric Co.,

Pittsburgh, Pennsylvanie.

Mon cher M. Schmid : -

Cela vous présentera M. JJ Bellman, qui souhaite obtenir un

poste dans une entreprise d'électricité. Il n'est pas nécessaire que je témoigne de ses qualités, puisque son certificat

du Columbia College le montrera. En faisant appel à ses services, vous apporterez un apport très précieux à

votre personnel, et m'oblige grandement,

Cordialement,

46, rue E. Houston,

New York, 6 juin 1895.

M. Albert Schmid,

Westinghouse Electric Co.,

Pittsburgh, Pennsylvanie.

Mon cher M. Schmid : -

Votre dépêche d'hier, pour laquelle je vous remercie, a été reçue. je

Je suis un peu déçu d'apprendre que l'envoi ne me sera pas effectué avant mardi prochain.

Sachant qu'il ne peut y avoir d'erreur sur aucune dynamo que vous concevez, je considère le test comme superflu.

affaire, et je vous suggère d'expédier la machine directement. Veuillez également veiller à ce que l'appareil soit

pas indûment retardé sur le chemin de fer. Je n'ai pas envie de dépenser quelques dollars de plus, à condition de les obtenir

plus vite.

Cordialement,

46, rue E. Houston,

New York, 10 juin 1895.

M. Albert Schmid,

Westinghouse Electric Co.,

Pittsburgh, Pennsylvanie.

Mon cher M. Schmid : -

Votre dépêche de samedi m'est parvenue en fin d'après-midi. je remercie

merci beaucoup pour l'attention prompte portée à ma lettre et j'espère que la machine s'est entièrement déroulée.

à votre satisfaction, ce qui revient à dire qu'il ne peut être amélioré davantage.

Vous augmenterez mes obligations si vous m'informez de la date à laquelle vous comptez expédier ma bobine haute tension. Il

Cela doit être très bien avancé, à en juger par la lettre que M. Scott m'a écrite il y a quelque temps. j'espere aussi

que vous pourrez acheter la boîte de départ avec le transformateur rotatif.

En espérant avoir bientôt le plaisir de vous revoir, je suis

Cordialement,

46, rue E. Houston,

New York, 13 juin 1895.

M. Albert Schmid, surintendant,

Westinghouse Electric Co.,

Pittsburgh, Pennsylvanie.

Mon cher M. Schmid : -

Votre lettre du 12 juin vient de me parvenir. Je suis très content d'apprendre ça

le générateur a été expédié, et que j'ai maintenant la perspective de continuer bientôt la gamme de

expérience qui a été interrompue il y a quelques mois. Veuillez m'obliger à me faire parvenir dès que vous serez prêt,

car il me sera difficile de faire fonctionner le moteur sans cela.

J'apprécie l'utilisation de fils d'argent allemands assurant une résistance constante, et je l'apprécierai d'autant plus si le

la facture s'avère être petite. L'exigence ultérieure est bien plus importante pour moi que la constante

résistance.

En espérant que le convertisseur sera expédié dans les délais promis, et en vous remerciant pour votre aide,

Je suis

Très sincèrement vôtre,

46, rue E. Houston,

New York, 15 juin 1895

M. George Westinghouse, Jr.,

La ville de New York.

Notant vos efforts pour mettre en garde le public contre les violations de mon

brevets sur les moteurs multiphasés, je suis poussé par un sentiment d'amitié à vous faire remarquer personnellement que

vos publicités ne mettent pas clairement en évidence le fait que ces brevets couvrent non pas un, mais plusieurs

lignes d'importance presque équivalente dans l'introduction pratique du système, mais plutôt de le rendre

Il semblerait aux non-informés que tout dépend d'une seule caractéristique. Vous pouvez facilement le constater avec un

quelques mots, vos déclarations pourront être rendues beaucoup plus fortes et exprimeront plus exactement l'état de

des choses.

J'aimerais à cette occasion attirer votre attention sur un autre point. Il y a quelques années, lorsque le

Les avantages de mon système ont été discutés par certains experts, j'ai insisté sur le fait que lorsqu'un grand nombre

des moteurs, des lampes et d'autres dispositifs fonctionnent sur le système multiphasé l'efficacité du système

dans son ensemble doit être supérieur au rendement moyen d'un seul moteur. Puisque vous avez une grande usine

maintenant en opération, la véracité de mon affirmation peut maintenant être testée dans la pratique. Si vous mesurez le

consommation de vapeur, vous constaterez forcément que les résultats sont meilleurs que ceux que l'on peut obtenir avec le

système à courant continu, bien qu'il soit tout à fait possible qu'un seul moteur à courant continu puisse donner un léger

meilleur résultat qu'un seul moteur alternatif.

Sincèrement votre,

46, rue E. Houston,

New York, 15 juin 1895

M. Albert Schmid, surint. Westinghouse Elec. Co.,

Pittsburgh, Pennsylvanie.

Mon cher M. Schmid : -

N'ayant pas encore reçu à ce jour la facture de la rotation

transformateur, que vous m'informez que vous avez expédié lundi dernier, vraisemblablement par fret, je vous prie

vous d'expédier le boîtier de régulation ainsi que la bobine haute tension par express. Je suppose que le poids de

cet appareil ne sera pas de nature à rendre l'expédition de cette manière coûteuse.

En vous remerciant d'avance, je suis

Cordialement,

Société d'électricité et de fabrication Westinghouse

120 BROADWAY

NEW YORK, NY18 juin 1895 .

N. Tesla, Esq.,

46, rue East Houston, ville.

Cher M. Tesla,

J'ai votre faveur du 15ème instant . qui recevra ma meilleure attention. Je suis

je vous suis reconnaissant de m'avoir écrit à ce sujet. Nous sommes soucieux de donner autant d'importance que possible

à chaque fonctionnalité en rapport avec vos inventions.

Sincèrement,

Géo. Westinghouse Jr.

46, rue E. Houston,

New York, 19 juin 1895.

M. Albert Schmid, GÉNÉRAL (Surint.)

Westinghouse Electric Co.,

Pittsburgh, Pennsylvanie.

Mon cher Général : -

Notre dépêche d'hier, pour laquelle je vous suis très reconnaissant, a été reçue,

et depuis, j'ai également reçu un accusé de réception. Je n'ai pas encore réussi à localiser le transformateur ; il semble que

être toujours en cours. Compte tenu de cela, je vous prie de toujours expédier les marchandises ou d'effectuer des communications,

sauf de nature personnelle, à mon laboratoire, 46, East Houston Street.

En vous remerciant d'avance, je suis

Cordialement,

46, rue E. Houston,

New York, 20 juin 1895.

M. Albert Schmid, surintendant général,

Westinghouse Electric Co.,

Pittsburgh, Pennsylvanie.

Mon cher M. Schmid : -

Votre dépêche concernant les convertisseurs m'a été remise ce moment, et je vous ai répondu immédiatement par télégramme, vous demandant d'acheter les convertisseurs par express, en vue

Du long retard du fret. Je suis très déçu de ne pas avoir, pour l'instant, reçu de nouvelles de la rotation

virement, même si cela fait maintenant plus de dix jours que, selon votre lettre, il a été expédié.

Avec mes meilleurs remerciements pour votre gentillesse et dans l'attente du plaisir de vous revoir bientôt, je suis

Très sincèrement vôtre,

46, rue E. Houston,

New York, 21 juin 1895.

M. Albert Schmid, surintendant général,

Westinghouse Electric Co.,

Pittsburgh, Pennsylvanie.

Mon cher M. Schmid : -

Le transformateur rotatif a enfin été reçu, et je suis très

satisfait de la première inspection de la machine, qui montre que vous lui avez accordé plus que ce que vous aviez prévu.

soins habituels.

Je vous serai très obligé si vous avez la gentillesse de m'envoyer des plans de la machine, et autres

précisions que vous pouvez donner sans vous départir de la pratique habituelle de votre société en matière

importe. J'aimerais bien sûr tout savoir sur le bobinage et les constantes du

fer, afin de pouvoir profiter au plus tôt des expériences faites avec cette machine.

En espérant que l'appareil haute tension sera reçu en bon état, je suis

Très sincèrement,

46, rue E. Houston,

New York, 22 juin 1895.

M. Albert Schmid, surintendant général,

Westinghouse Electric Co.,

Pittsburgh, Pennsylvanie.

Mon cher M. Schmid : -

J'ai fait tourner le moteur hier et j'ai été très heureux de constater l'excellent

améliorations que vous avez apportées à ces machines par rapport à celles d'il y a deux ou trois ans. je n'ai aucun doute

qu'il s'agit d'une machine très efficace, à en juger par la rapidité avec laquelle la régulation de la vitesse est effectuée.

effectué. Mon idée était que vous expédiiez une poulie avec le moteur, comme vous le faites avec des générateurs.

La taille qui me convient le mieux serait entre 16 et 20 pouces. J'aimerais que tu en envoies un

qui est très bien équilibré, de cette taille, ou légèrement plus grand.

En espérant avoir de vos nouvelles par retour de courrier, je suis

Cordialement,

46, rue E. Houston,

New York, 21 juin 1895.

M. Albert Schmid, surintendant général,

Westinghouse Electric Co.,

Pittsburgh, Pennsylvanie.

Mon cher M. Schmid : -

Je constate dans votre lettre d'il y a quelques jours que vous avez expédié

le boîtier de régulation de champ du transformateur rotatif. Comme je ne l'ai pas encore reçu, je vous prie de voir

s'il a été expédié avec le transformateur.

J'espère que vous pourrez expédier la boîte de départ très bientôt.

Cordialement,

46, rue E. Houston,

New York, 24 juin 1895.

M. Albert Schmid, surintendant général,

Westinghouse Electric Co.,

Pittsburgh, Pennsylvanie.

Mon cher M. Schmid : -

Voudriez-vous bien faire parvenir, le plus rapidement possible, des anneaux de tôle, 9-

1/2 pouces à l'intérieur et 11 pouces de diamètre extérieur ? L'épaisseur de la tôle doit être comprise entre

1/64 et 1/32 de pouce, ou quelle que soit l'épaisseur que vous utilisez dans vos armatures. Le fer doit être du

de la plus haute qualité et du meilleur recuit, et j'aurai besoin d'environ 100 livres de ces plaques.

En espérant que vous aurez la gentillesse de commander personnellement ce matériel, je suis

Cordialement,

46, rue E. Houston,

New York, 25 juin 1895.

M. Albert Schmid, surintendant général,

Westinghouse Electric Co.,

Pittsburgh, Pennsylvanie.

Mon cher M. Schmid : -

Je viens de recevoir les convertisseurs haute tension, et je dirais que ils représentent une amélioration considérable par rapport aux anciens. J'espère que vous êtes vous-même dérivé du expérience utile dans la construction de ces transformateurs.

En espérant qu'ils se dérouleront comme je l'espérais et en vous remerciant pour la peine que vous avez prise m'occupant de l'affaire, je suis

Cordialement,

46, rue E. Houston,

New York, 26 juin 1895.

M. Albert Schmid, surintendant général,

Westinghouse Electric Co.,

Pittsburgh, Pennsylvanie.

Mon cher M. Schmid : -

En examinant les convertisseurs haute tension que j'ai reçus hier, je constate que quelques erreurs ont été commises, que je ne signalerai pour aucune autre raison que le désir de vous être utile.

Je trouve qu'au lieu du fer laminé comme demandé dans ma première communication avec vous, il y a ont été placées des barres de fer plates aux extrémités du noyau. De plus, il n'y avait pas de trous en bas ni sur les côtés prévus pour la circulation de l'huile. La connexion médiane des deux bobines secondaires aurait dû être isolé par une bague en caoutchouc ou autrement pour empêcher une percée, lorsque par inégalement les bornes, la bobine devient déséquilibrée. Un autre défaut était que la bobine était placé trop bas, mais j'y ai facilement remédié en plaçant quelques planches en dessous. Un autre oubli a été réalisé en clouant les extrémités du fil haute tension au cadre car vous savez qu'aucun peu importe le degré de sécheresse du bois, il conduira un tel courant de haute tension et court-circuitera la bobine. Le vis qui fixaient les extrémités des secondaires aux fils terminaux passant à travers le caoutchouc les colonnes auraient dû être placées sur le côté, car elles peuvent facilement tomber et se déconnecter, telles qu'elles sont. fait. Le fil primaire aurait dû être enfoncé dans le bois, comme l'exige mon croquis, ceci étant nécessaire pour permettre l'insertion des plaques de fer laminées à l'opposé des extrémités du noyau.

Sinon, la bobine semble parfaitement confectionnée et les pièces bien fixées au cadre. je considérer la disposition de la plaque de bois centrale avec les blocs sur les côtés pour conserver le secondaire Bobines en position, une très bonne.

Vous m'obligerez à vous transmettre les détails exacts qui se rapportent à ces bobines, et je vous laisserai

vous savez immédiatement après les avoir testés dans quelle mesure ils répondent aux exigences.

En espérant que vous ne prendrez pas ces remarques comme une critique défavorable, et vous remerciant encore pour

votre gentillesse, je suis

Cordialement,

46, rue E. Houston,

New York, 29 juin 1895.

M. Albert Schmid, surintendant général,

Westinghouse Electric Co.,

Pittsburgh, Pennsylvanie.

Mon cher M. Schmid : -

Votre lettre du 28 juin a été reçue et je vous remercie pour les informations qu'elle contient.

En examinant plus avant les bobines, j'ai constaté qu'il y avait un défaut plus grave, auquel il était cependant facile de remédier. Si je mentionne cela, vous saurez bien sûr que cela est fait avec les motivations les plus amicales .

J'ai découvert que sur les extrémités secondaires qui étaient reliées au milieu au-dessus du primaire, il y avait deux plaques de laiton fixées d'un pouce et demi de long et d'environ ¼ de pouce de large. Ces plaques de laiton auraient dû être placées tangentiellement à la bobine. Au lieu de cela, ils ont été placés radialement et à plus de ¼ de pouce au-delà de la première couche secondaire. Comme l'ensemble du fil secondaire occupe 5 pouces, les pièces de laiton étaient ainsi faites pour s'étendre sur 60 à 70 couches, et ce défaut était encore accru par les vis dépassant d'une bonne profondeur dans la fibre. En cas de vibration superposée dans le secondaire, il pourrait facilement y avoir 100 000 volts entre les couches recouvertes par la plaque de laiton, et la bobine tomberait sûrement en panne. Le fait que les anciennes résistances tombaient en panne de cette façon, et je vous en informais particulièrement, mais j'ai oublié de le mentionner lorsque j'ai commandé les résistances actuelles.

J'ai placé le fer laminé, et j'ai soudé les extrémités du secondaire au milieu, en supprimant les deux plaques de laiton, car elles étaient inutiles et ne pouvaient que causer des ennuis.

J'ai été heureux, en examinant les bobines, de constater que la charpente en bois était parfaitement confectionnée et que tout semblait par ailleurs en parfait état, et il était tout à fait évident pour moi que vous aviez pris grand soin dans la construction de ces bobines.
Avec beaucoup de remerciements, je suis

sincèrement vôtre,

46., rue Houston,

New York, le 2 juillet 1895

M. Albert Schmid, surintendant général,

Westinghouse Electric Co.,

Pittsburgh, Pennsylvanie.

Mon cher M. Schmid : -

Vous vous souviendrez peut-être que l'automne dernier, j'ai pris la liberté de

vous recommandant, par lettre, M. Emile Smith. Il est diplômé de l'université et a

possède une certaine expérience pratique en génie mécanique et électrique.

Vous savez que je ne recommande pas souvent les gens, mais la bonne opinion que j'ai de M. Smith

m'incite à vous écrire une nouvelle fois et à vous demander si vous ne pourriez pas lui donner un

poste actuellement dans certaines de vos usines. Si vous le faites, vous m'obligerez.

Cordialement,

46., rue Houston,

New York, le 3 juillet 1895

M. Albert Schmid, surintendant général,

Westinghouse Electric Co.,

Pittsburgh, Pennsylvanie.

Mon cher M. Schmid : -

Je viens de recevoir les plans du 30 HP

transformateur rotatif, et je tiens à vous en remercier. Le boîtier de résistance en fil d'argent allemand pour

le démarrage du transformateur n'a pas encore été reçu, mais je présume qu'il est expédié ou sinon,

qu'il sera prochainement transmis. J'ai reçu le coffret pour le règlement de terrain.

Dans certains de mes tests, j'aimerais faire tourner le transformateur jusqu'à environ 1200 tours

par minute; ce serait 50 % plus élevé que la vitesse normale. Je suis convaincu qu'il y aurait

ne présente aucun danger, à en juger par l'aspect général de la machine, mais je vous prie de

faites-moi savoir si vous considérez une telle course en toute sécurité.

En attendant une réponse rapide, je suis

Très sincèrement vôtre,

46., rue Houston,

New York, 10 juillet 1895

M. Albert Schmid, surintendant général,

Westinghouse Electric Co.,

Pittsburgh, Pennsylvanie.

Mon cher M. Schmid : -

Pourriez-vous bien vouloir me faire parvenir à mon adresse ci-dessus, six douzaines de grands

les bornes de reliure que vous posez habituellement sur votre appareil ? Je veux la taille que tu mets

le transformateur rotatif.

En attendant une réponse rapide, je suis

Cordialement,

46., rue Houston,

New York, 10 juillet 1895

M. Albert Schmid, surintendant général,

Westinghouse Electric Co.,

Pittsburgh, Pennsylvanie.

Mon cher M. Schmid : -

Votre faveur du 8 juillet reçue .

Je peux seulement dire en faveur de M. Smith que son nom ressemble au vôtre, et à son désavantage qu'il me ressemble. J'espère que cette dernière objection ne constituera pas une objection sérieuse, et

je vous prie également de vous rappeler que les eaux calmes sont profondes.

En espérant que vous pourrez faire quelque chose pour lui, je suis

Cordialement,

46., rue Houston,

New York, le 11 juillet 1895

M. Albert Schmid, surintendant général,

Westinghouse Electric Co.,

Pittsburgh, Pennsylvanie.

Mon cher M. Schmid : -

Votre faveur du 20 juillet reçue , dont j'apprends avec plaisir que la boîte de départ sera expédiée aujourd'hui.

Dans ma lettre d'hier, je vous ai demandé d'envoyer six douzaines de vos reliures, et je répète ici que vous m'obligerez à les envoyer sans délai.

En plus de ces bornes de reliure, j'aimerais récupérer quelques-uns de vos simples et doubles.

des interrupteurs parce que je peux les obtenir moins cher chez vous que chez le fournisseur ici. Gentiment

avancez une demi-douzaine de commutateurs doubles et une demi-douzaine de simples. Les derniers devraient être, en gros,

pour environ 50 ampères, et le premier pour environ 100 ampères dans chaque circuit.

Pour certains appareils que je conduis avec du courant alternatif, j'ai besoin de quelques de petits moteurs alternatifs. La meilleure taille pour moi serait d'environ ¼ de HP, biphasé et environ 1/8 d'un moteur à induction monophasé HP, si vous en avez un sous la main. Le FEM est immatériel; Je suppose que vous les enroulez pour 100 ou 50 volts.

Si ces tailles ne sont pas disponibles, veuillez me laisser la taille la plus proche.

En espérant que vous aurez la gentillesse de vous occuper de cette affaire, je suis

Cordialement,

46., rue Houston,

New York, le 12 juillet 1895

M. Albert Schmid, surintendant général,

Westinghouse Electric Co.,

Pittsburgh, Pennsylvanie.

Mon cher M. Schmid : -

Votre lettre du 11 juillet reçue . Je voulais dire le genre de liaison-

poteaux que vous mettez habituellement sur vos dynamos. Je pensais que tu en avais un grand nombre

bornes de reliure en stock, car vous les utilisez constamment, et je souhaiterais une grande taille.

Tout ce que vous sélectionnerez me conviendra. J'en ferais ma boutique, mais je ne peux pas

gagner du temps, car je dois garder mes hommes sur des travaux plus importants.

En espérant que vous pourrez trouver quelque chose qui conviendra à mes besoins, et en vous remerciant, je suis

Cordialement,

46., rue Houston,

New York, 24 juillet 1895

M. Albert Schmid, surintendant général,

Westinghouse Electric Co.,

Pittsburgh, Pennsylvanie.

Mon cher M. Schmid : -

Votre lettre et votre plan de reliure reçus. Gentiment

excusez le retard de ma réponse, dû à quelques dérangements dans mon bureau.

J'ai pris la liberté de découper l'empreinte du courrier que je demanderai à

votre feuille d'échantillon. Vous m'obligerez grandement si vous m'envoyez six douzaines de ces reliures...

messages dans les meilleurs délais.

Je n'ai pas encore reçu les moteurs et interrupteurs dont je vous ai parlé.

avant. J'estime qu'ils ont été transmis conformément à votre promesse.

En vous remerciant pour votre gentillesse, je suis

Cordialement,

46., rue Houston,

New York, 26 juillet 1895

M. Albert Schmid, surintendant général,

Westinghouse Electric Co.,

Pittsburgh, Pennsylvanie.

Mon cher M. Schmid : -

Votre lettre du 25 juillet vient de me parvenir. J'ai câblé

répondez comme suit : « Veuillez envoyer les bornes de liaison seules, non montées par paires. Obligatoire par expédition

sans délai par express.

J'espère que vous pourrez expédier ces reliures cette semaine, comme je les veux ; et

également que les moteurs ½ HP ont été expédiés conformément à votre lettre.

Très sincèrement,

46., rue E. Houston,

New York, 7 août 1895

M. George Westinghouse, Jr.,

La ville de New York.

Mon cher M. Westinghouse : -

J'apprends des journaux de ton accord amical

avec les travaux de locomotives Baldwin. Prévoyant le développement du chemin de fer électrique, j'ai

j'ai souvent réfléchi aux avantages d'une telle coopération et, il y a longtemps, j'avais en tête de

vous en parler. La nouvelle de votre consolidation a été pour moi une agréable surprise.

Une si belle union de moyens et de capacités ne peut manquer d'intéresser les deux parties.

concerné.

Sincèrement vôtre,

Société d'électricité et de fabrication Westinghouse

120 BROADWAY

NEW YORK, NY8 août 1895.

N. Tesla, Esq.,

N° 46, rue East Houston,

Ville de New York.

Cher M. Tesla :

Je vous suis très reconnaissant pour votre lettre du 7 août . C'est une autre indication de

l'intérêt que vous portez à Westinghouse Electric and Manufacturing Co. Nous pensons tous que le

les accords commerciaux conclus avec le peuple Baldwin produiront de bons résultats.

J'espère que le moment n'est pas loin où vous sentirez que vous pourrez visiter nos nouvelles œuvres.

à Pittsburgh pour observer le fonctionnement de vos moteurs dans la pratique quotidienne ainsi que pour comprendre

de nos installations.

Sincèrement votre,

Géo. Westinghouse Jr.

Président.

46., rue E. Houston,

New York, 14 août 1895

M. George Westinghouse,

La ville de New York.

Cher M. Westinghouse : -

Professeur LB Atkinson du South Wales Institute of

Ingénieurs, m'a écrit une lettre demandant des données d'essais avec des moteurs à courant alternatif. je

Je crois qu'il est motivé par des motivations amicales et qu'il ferait des déclarations justes. Si vous êtes

enclin à publier quoi que ce soit, il serait bon de le faire par son intermédiaire. Peut-être avez-vous l'intention

d'envoyer quelques moteurs en Angleterre, et dans ce cas leurs performances devront être

annoncé.

Vous m'obligerez si vous vous souvenez du professeur Atkinson lors d'une future occasion de ce genre,

mais bien sûr, je ne souhaite pas influencer votre décision d'une autre manière.

Cordialement,

GÉO. WESTINGHOUSE, JR.

PITTSBURGH, Pennsylvanie.

15 août 1895 .

N. Tesla, Esq.,

46 E. Houston Street, New York.

Cher M. Tesla : -

J'ai votre faveur du 14 et je l'enverrai au bureau d'East Pittsburgh afin que notre les gens sur place peuvent régler le problème selon vos souhaits.

Sincèrement votre,

Géo. Westinghouse Jr.

Société d'électricité et de fabrication Westinghouse

Pittsburgh, Pennsylvanie.

4 septembre 1895

M. Nikola Tesla

La ville de New York.

Cher Monsieur: -

Cette lettre vous sera remise par M. Cleveland Moffat , au sujet duquel vous avez déjà une lettre signée par M. Bannister et envoyée par la poste par erreur.

Votre serviteur,

Westinghouse Electric & Mfg. Co.,

JF Tener

Sécrétaire privée

Société d'électricité et de fabrication Westinghouse

Pittsburg, Pennsylvanie.

11 octobre 1895

Nikola Tesla, Esq.,

Le Gerlach, à New York,

Cher Monsieur: -

En juillet dernier, un jeune homme du nom d'Emil Smith est venu nous voir avec des lettres

de recommandation de votre part. Il a été mis au travail à l'usine vers le milieu du mois dernier.

tombé malade de la fièvre typhoïde. Il est allé à l'hôpital homéopathique de cette ville mais son état ne s'est pas amélioré.

Samedi dernier, ils ont télégraphié pour ses proches. Sa sœur et une amie sont arrivées dimanche,

et est resté avec lui jusqu'à sa mort hier (jeudi après-midi à 14 heures).

Je me suis occupé des affaires et de tout embaumement de son corps, etc., en le transmettant dans le train de 8 heures.

hier soir à Détroit. Les restes étaient accompagnés de Miss Smith et de Mme Leitner.

Comme il était un de vos amis personnels, j'ai pensé que vous seriez peut-être intéressé d'apprendre sa mort.

Sincèrement vôtre,

Henri Floy

Société d'électricité et de fabrication Westinghouse

Pittsburg, Pennsylvanie.

16 décembre 1895

M. Nikola Tesla,

Le Gerlach,

New York.

Cher Monsieur,

Je vous envoie sous un autre pli une série de circulaires décrivant notre appareil. Le

la publication de cette série de circulaires a été entreprise depuis quelques mois, et vous remarquerez qu'un

nombre d'entre eux décrivent des machines que nous fabriquons depuis plusieurs années. Nous

envoyez également une des enveloppes souples prévues pour le dépôt, et notre M. Dickson veillera à ce qu'une copie

de chaque circulaire supplémentaire vous est envoyée par la poste de temps à autre telle qu'elle a été publiée.

Je pense que vous serez particulièrement intéressé par les circulaires nos 3 et 10, et si vous avez des critiques

ou suggestion, nous serons très heureux de la recevoir et d'en profiter.

Sincèrement votre,

LB Stillwell

LBS/AD.

Société d'électricité et de fabrication Westinghouse

Pittsburg, Pennsylvanie.

24 décembre 1895

M. Nikola Tesla,

#46 et 48 rue Est Houston. , La ville de New York,

Mon cher monsieur: -

Votre très aimable lettre du 19 décembre est bien reçue et j'apprécie grandement votre volonté pour nous aider en autorisant l'utilisation de votre nom et de votre photo. J'ai montré votre lettre à M. Westinghouse, et il a exprimé sa gratitude.

Cependant, en réfléchissant à la question et en l'envisageant plutôt de votre point de vue, je conclu qu'avant de réaliser mon projet de publicité chez Cassier, il serait judicieux d'avoir un parler avec vous, et éventuellement avec M. Adams, afin qu'il n'y ait aucun malentendu possible ou d'insatisfaction. J'ai donc reporté l'annonce et j'en ai informé Cassier Magazine Co.

En vous remerciant encore pour votre courtoisie, je suis

Sincèrement vôtre,

LB Stillwall,

Ingénieur électrique. & Asst. Mgr.

Société d'électricité et de fabrication Westinghouse

Pittsburg, Pennsylvanie.

26 décembre 1895

Nichola Tesla, Esq.,
46 East Houston St.,
New York, NY

Cher Monsieur: --

17 juillet , je vous prie de nous informer que nous avons la puissance d'un demi-cheval,

Moteur AC monophasé prêt à être expédié. Veuillez nous informer si vous devez expédier par fret ou express.

Sincèrement vôtre,

WESTINGHOUSE ÉLECTRIQUE ET MFG.

CO.

Par D. Carlington

Société d'électricité et de fabrication Westinghouse

Pittsburg, Pennsylvanie.

23 décembre 1895

Albert Schmid,
surintendant général

M. Nikola Tesla,

Le Gerlach,

New York, New York

Mon cher M. Tesla : ---

J'ai prévu de partir à l'étranger à la fin du 22 janvier et j'espère pouvoir faire une longue tournée à travers l'Europe. Je visiterai l'Italie, la France, l'Allemagne, l'Autriche, la Suisse, l'Angleterre, etc., et je considérerais comme une grande faveur si vous pouviez m'envoyer, dans les meilleurs délais, des lettres de introduction à des entreprises comme les Ganz, Scheider & Company, Helios Company et à certains des électriciens et ingénieurs éminents dans les pays ci-dessus ; ainsi que M. Brown, de Suisse. je verrai toi avant de partir.

Avec mes meilleurs vœux pour la saison, je reste,

Sincèrement vôtre,

Albert Schmid

COMME

New York, le 31 décembre 1895

#46 et 48 E. Houston Str.

Westinghouse Electric Co.,

Pittsburgh, Pennsylvanie.

Messieurs: -

Votre faveur du 26 décembre m'est parvenue.

Je suis heureux d'apprendre qu'un moteur à courant alternatif monophasé d'un demi-HP est prêt et je souhaite dire que

Je vous serai obligé de l'expédier avec retard, car j'en ai vraiment besoin.

En espérant le recevoir en bon état, je le suis,

Sincèrement vôtre,

New York, le 31 décembre 1895

#46 et 48 E. Houston Str.

M. Albert Schmidt,

Surintendant Westinghouse Electric Co.,

Pittsburgh, Pennsylvanie.

Cher M. Schmidt: -

Merci pour la parenthèse de vos bons vœux, dont j'ai toujours été sûr.

Rien ne me procurera un plus grand plaisir que de répondre à votre souhait en la matière, et bien que vous ayez besoin de lettres, peu importe, votre travail, dont vous pouvez être fier, est le meilleur recommandation.

Anticipant le plaisir de vous revoir bientôt, je suis

Cordialement,

Société d'électricité et de fabrication Westinghouse

120 BROADWAY,

New York, NY, 20 février 1896.

Nikola Tesla, Esq.,

46 E. Houston St.,

Ville.

Cher Monsieur: -

Nous serions heureux que vous utilisiez votre influence pour que le Dr Louis Duncan soit nominé pour

Présidence de l'American Institute of Electrical Engineers pour l'année à venir.

Votre serviteur,

WM. P.ZIMMERMANN,

Agent général de l'Est.

New York, 13 mars 1896.

#46 et 48 E. Houston Str.

M. PD Lange,

Surintendant Westinghouse Co.,

Pittsburg, Pennsylvanie.

Mon cher M. Lange : -

Je connais M. OA Sandborgh depuis un certain temps et je pense qu'il est un homme très

un homme bon dans tous les domaines.

C'est un excellent dessinateur et, autant que je sache, il pourrait se frayer un chemin dans n'importe quel domaine.

départements de vos grands travaux. Je serais heureux de lui donner un poste dans ma propre boutique, si j'avais un

opportunité. Vous m'obligerez grandement si vous faites pour lui ce que vous pouvez, et j'espère que vous le ferez.

raison
pour que vous soyez satisfait de ses services, si vous lui donnez un emploi.

Cordialement,

Westinghouse Electric & Manufacturing Company

Pittsburg, Pennsylvanie , 18 mars 1896

ADRESSE TOUTES LES COMMUNICATIONS

À LA SOCIÉTÉ.

M. Nikola Tesla,

Le Gerlach,

New York.

Mon cher monsieur,

J'ai dûment reçu samedi dernier votre télégramme nous demandant de faire preuve de courtoisie envers votre ami M.

Maurel, le chanteur. Cela nous ferait plaisir de recevoir la visite de M. Maurel, mais jusqu'à présent

écrivant, il n'est pas, à notre connaissance, apparu à Pittsburg. S'il nous appelle, vous pouvez être sûr

que nous serons heureux de lui accorder toute notre attention, à la fois parce qu'il est M. Maurel et parce que vous

l'ont demandé.

Sincèrement votre,

LB Stillwell

Élect. Ingénieur & Compte. Directeur

LBS/AD.

New York, le 2 mai 1896

#46 et 48 E. Houston Str.

M. WHD Lange,

Westinghouse Electric Co.,

Pittsburgh, Pennsylvanie.

Mon cher M. Lange : -

Ceci vous présentera M. A. Pfeiffer, qui a été fortement recommandé pour moi, et en la capacité et l'intégrité duquel j'ai une grande confiance. Il a reçu une excellente formation à Sheffield Scientific School et a en outre effectué des travaux pratiques.

Si vous lui accordez l'occasion de vous convaincre de ses capacités, je vous en serais très reconnaissant.

Cordialement,

Société d'électricité et de fabrication Westinghouse.

120 BROADWAY,

NEW YORK, NY, 27 mai 1896

Nikola Tesla, Esq.,

N° 46 East Houston St., ville.

Cher Monsieur: -

Il y a quelque temps, alors que j'étais engagé dans un travail expérimental à East Pittsburgh, M.

Page m'a envoyé un de vos modèles de moteurs originaux qui lui avait été confié par vous. Dans

conformément aux instructions reçues hier de M. Page, je viens d'écrire à Pittsburgh pour donner des instructions

les expédier par express au 46 East Houston St. Lorsque le même sera reçu, veuillez-vous bien vouloir

Reconnais-le?

Sincèrement votre,

Ralph D. Mershon

COPIE.

E.d. Adams, bâtiment Mills, New York.

Le commodore Mellville a désigné le 17 comme jour satisfaisant pour partir pour Pittsburg.

L'arrangement est d'aller de Washington via Philadelphie, où nous dînerons au club avec TN Ely, de

Penna, RR, partant pour Pittsburgh à 22h25, se rendant à Niagara Falls samedi soir. Est-ce que cela vous conviendra

et M. Tesla, à qui veuillez envoyer une copie de ce télégramme. Vous et M. Tesla quitteriez New York le

16h30, train le 17 .

Géo. Westinghouse. 10 juillet 1896

GÉO. WESTINGHOUSE, JR.

PITTSBURGH, Pennsylvanie.

10 juillet 1896.

Nikola Tesla, Esq.,

Soins M. ED Adams, Mills Building, New York.

Cher M. Tesla : - Il y a environ deux ou trois semaines, j'ai parlé à M. Adams au sujet d'un visite proposée du commodore Mellville, de la Marine, à nos usines d'East Pittsburgh et à Niagara Falls étant particulièrement désireux que le Département de la Marine se familiarise avec les avantages du système multiphase pour toutes sortes d'opérations à bord des navires de guerre. Le Commodore fut obligé de reporter le voyage en raison de l'attribution de contrats pour de nouveaux navires de guerre, mais il est désormais prêt, et il est proposé de quitter Philadelphie le vendredi 17 au soir .

MTN Ely, le chef de la force motrice du Penna RR, qui nous accompagnera, nous a invités à dîner avec lui au Philadelphia Club vendredi soir.

J'ai envoyé à M. Adams un télégramme dont je vous joins une copie. Vous et M. Adams pourriez partir New York dans le train de 16h30, et nous vous retrouverons à la gare de Broad Street, à Philadelphie et puis rejoignez M. Ely pour le dîner.

J'attends ce voyage avec beaucoup de plaisir et j'espère qu'il se déroulera entièrement pratique pour vous de le faire.

Sincèrement,

Géo. Westinghouse

Société d'électricité et de fabrication Westinghouse.

120 BROADWAY,

NEW YORK, NY, 23 juillet 1896

Nikola Tesla, Esq.,

Le Gerlach,

New York, New York

Mon cher monsieur: -

Je vous envoie par express, un petit morceau de câble par lequel passait le premier courant généré dans l'usine de la Niagara Falls Power Co., à Niagara, le 16 avril 1895 .

Nous avons fourni des souvenirs similaires aux directeurs de la Cataract Construction Co., certains d'entre eux les officiers de notre propre compagnie, au commodore Melville et à M. Habirshaw, et sentant que vous êtes particulièrement intéressé, nous aurons grand plaisir à vous en faire parvenir un. S'il vous plaît, acceptez cela avec le meilleur compliments de la société Westinghouse.

Notre ami, le Dr Habirshaw, a réalisé le télégramme et peut tout vous dire. Des échantillons de la même manière isolés sont soumis à des tests de panne dans notre usine et n'ont en aucun cas été rompus par un potentiel de 45 000 volts (CA)

Je suis vraiment désolé de ne pas avoir eu le plaisir de vous montrer personnellement l'usine de Niagara, mais avec M. Adams et M. Rankine comme guides, et votre connaissance des appareils électriques, aucune caractéristique de un intérêt particulier aurait pu être négligé.

Vous serez peut-être intéressé de savoir que le Bureau des brevets m'a accordé un brevet couvrant le principaux éléments de l'organisation de l'appareillage du tableau de distribution, qui, je l'espère, seront utiles au Westinghouse Company pour obtenir des commandes supplémentaires pour l'extension de l'usine.

Ce fut un grand plaisir de vous voir à Pittsburgh et j'espère que votre prochaine visite ne sera pas si longue.

retardé comme l'était le dernier.

Sincèrement votre,

LB Stillwell

New York, le 1er août 1896.

#46 et 48 E. Houston Str.

Monsieur HD Lange,

Surintendant Westinghouse Electric Co.,

Pittsburg, Pennsylvanie.

Mon cher M. Lange : -

M. Moulton m'a été très fortement recommandé. Je l'ai vu et il

m'a impressionné en tant qu'homme ayant une connaissance approfondie des machines et des expériences habituelles. C'est mon

Je pense que si vous lui donniez un emploi, vous seriez entièrement satisfait de ses services.

Sincèrement vôtre,

Enceinte.

Société d'électricité et de fabrication Westinghouse.

Pittsburg, Pennsylvanie, 4 septembre 1896

M. Nikola Tesla

La ville de New York, New York

Cher Monsieur:

J'ai pris la liberté de vous envoyer sous pli séparé un exemplaire de mon premier roman, intitulé « Hélène », et même si je n'oublie pas que vous êtes un homme très occupé, je flatte moi-même, que vous serez suffisamment intéressé par ce livre pour me faire l'honneur de l'accepter.

Cordialement,

Ernest H. Heinrich

New York, 3 janvier 1897.

#46 et 48 E. Houston Str.

Westinghouse Electric & Manufacturing Co.,

Pittsburgh, Pennsylvanie.

Messieurs :

Auriez-vous l'amabilité de nous faire parvenir certains de vos catalogues relatifs aux produits polyphasés moteurs, à l'adresse suivante : Dr S. Kimura, professeur de physique, Sendai, Koto Gakka, Japon.

Je serai très reconnaissant de votre attention et j'espère que finalement quelque chose dans votre intérêt peut en résulter.

Sincèrement votre,

New York, 22 mai 1897 .

#46 et 48 E. Houston Str.

MSF Scott,

Électricien Westinghouse Elec. Co.,

Pittsburgh, Pennsylvanie.

Mon cher M. Scott : -

Je voudrais par la présente vous présenter M. J. Tachihara, arrivé du Japon

en vue d'acquérir des connaissances pratiques sur les machines électriques, notamment sur les longues distances

transmission de puissance.

Toute aide ou courtoisie qui lui sera apportée sera très appréciée par

Cordialement,

Société d'électricité et de fabrication Westinghouse.

Agence de Pittsburgh

Pittsburg, Pennsylvanie, 28 mai 1897

M. Nicola Tesla

New York, New York (East Houston St.)

Mon cher Monsieur Tesla : -

Un de mes amis responsable de la propriété Adams Mining, une mine de minerai de fer

propriété des intérêts Rockafelter dans le Minnesota. Ils comptent bien sûr un grand nombre d'opérateurs et

les accidents se produisent continuellement. Ils ont un système hospitalier et médical très progressiste.

sous la responsabilité d'un médecin très compétent, nommément le Dr Moore. Le Dr Moore veut sécuriser un appareil à rayons X

qui lui permettent en cas d'accident sur un homme de prendre une photographie rapide des parties blessées, et

à partir de là, déterminez la meilleure méthode de procédure. Si possible, il aimerait avoir une machine

ce qui lui permettrait de photographier à travers la hanche avec une pose de cinq minutes. C'est le

Je me souviens que vous êtes intéressé par la fabrication d'une telle machine. Si mon impression est

correct, veuillez-vous m'envoyer les circulaires que vous pourriez avoir et me dire si les photos qu'il a

les désirs sont à la portée des possibilités au stade actuel de la technique.

En vous remerciant d'avance pour votre courtoisie à ce sujet, je vous prie de rester,

Votre serviteur,

Arthur Hartwell

Société d'électricité et de fabrication Westinghouse.

Agence de Pittsburgh

Pittsburg, Pennsylvanie, 5 juin 1897.

M. Nicola Tesla,

46 E. Houston St.,

New York, New York

Mon cher M. Tesla,

J'ai votre aimable faveur du 3 ème instant, pour laquelle veuillez accepter l'invitation de l'écrivain

merci. J'ai conseillé au Dr Moore d'attendre son achat jusqu'à ce que votre machine soit prête ou sur le marché.

Dès que ce sera le cas, aurez-vous la gentillesse de m'envoyer des informations détaillées concernant l'appareil.

En vous remerciant de votre courtoisie à ce sujet, et en particulier de votre aimable invitation, que je

J'ai transmis au Dr Moore, je vous prie de rester,

Votre serviteur,

Arthur Hartwell

New York, le 9 juin 1897

#46 et 48, rue E. Houston.

MCF Scott : -

Cette lettre vous sera présentée par M. A. Ehnhardt, qui m'est recommandé hautement par certains amis européens. En tant qu'ingénieur électricien, il s'intéresse naturellement beaucoup à inspectant vos travaux, et je vous serais très reconnaissant pour toute facilité que vous pourriez lui offrir à son propos.

Cordialement, je suis

Cordialement,

Société d'électricité et de fabrication Westinghouse

Agence de Pittsburgh

Pittsburg, Pennsylvanie, 15 juin 1897

Cher M. Tesla :

Le document ci-joint d'aujourd'hui, Leader, vous permettra probablement de vous sentir coupable pendant quelques instants.

amusement.

Cordialement,

EH Heinrich

New York, 19 juin 1897 .

#46 et 48 E. Houston Str.

M. RH Heinrichs,

Westinghouse Electric Co.,

Pittsburgh, Pennsylvanie.

Cher M. Heinrichs: -

Je vous suis très reconnaissant pour votre note du 15 juin que j'ai reçue, avec poème ci-joint.

Vous remarquerez qu'à peu près au même moment on essayait en France d'assassiner le président

Faure. Bien que ce dernier ait été un événement relativement insignifiant, vous ne manquerez pas d'être impressionné.

la singulière coïncidence.

Cordialement,

Société d'électricité et de fabrication Westinghouse

120 BROADWAY

NEW YORK, NY21 juin 1897 .

Nikola Tesla, Esq.,

Le Gerlach, 27 ème rue et B'way, ville.

Cher Dr Tesla –

Veuillez accepter mes remerciements pour votre lettre du 18 juin : je me sens grandement redevable à

vous remercie de l'intérêt que vous portez à cette affaire et je suis convaincu que ce que vous avez dit à M. Stewart

a joué un grand rôle dans l'évolution du contrat en notre faveur. Il est très gratifiant pour nous de pouvoir dire que nous

ont reçu les contrats de Niagara Falls et de Mesina Power.

Sincèrement votre,

Géo. Westinghouse

New York, 20 juin 1897 .

#46 et 48 E. Houston Str.

M. Charles F. Scott,

Westinghouse Electric Co.,

Pittsburgh, Pennsylvanie.

Mon cher M. Scott : -

Ceci vous présentera M. Kolomon von Kunde, ingénieur en chef d'un grand entreprise électrique d'Autriche-Hongrie, qui ne veut pas inspecter les travaux de Westinghouse et aussi de vous rencontrer personnellement.

Je suppose qu'il recevrait naturellement de vous toutes les courtoisies qui lui sont dues, et je souhaite seulement

à tous, je serai très reconnaissant pour toute facilité que vous pourrez lui accorder lors de sa visite.

Cordialement,

Société d'électricité et de fabrication Westinghouse.

120 BROADWAY,

NEW YORK, NY , 23 juillet 1897 :

Nikola Tesla, Esq.,

#46, rue East Houston, ville.

Cher Dr Tesla : -

Acceptez mes remerciements pour les vôtres du 22 ème inst. lettre ci-jointe de M. Sayers,

dont je transmettrai immédiatement une copie à notre bureau de Londres en leur demandant de donner l'affaire

attention rapide.

Comme demandé, je vous renvoie la lettre de M. Sayers.

Votre serviteur,

Géo. Westinghouse

Enc.

Société d'électricité et de fabrication Westinghouse.

120 BROADWAY,

NEW YORK, NY, 26 juillet 1897

Nikola Tesla, Esq.,

N° 46 East Houston St., New York.

Mon cher monsieur: -

Un de mes amis m'écrit pour me demander si vous pourriez donner une conférence au Music Hall du

Bibliothèque Carnegie, Pittsburgh. Ce ne sera pas un travail gratuit, et je pense que si vous vouliez leur faire la leçon

vous verserait l'indemnité habituelle, dont je ne connais pas le montant mais si vous considérez le

proposition, je serais ravi que vous me le fassiez savoir et je mettrai immédiatement la personne appropriée en place

communication avec vous. La question m'a été posée et je me permets donc d'écrire

vous à ce sujet, alors n'hésitez pas à faire ce que vous ressentez. Il n'y a aucune obligation de ma part,

et je le comprends, les conférences données dans cette salle sont données pour des « revenus ».

Si vous vouliez bien me faire part de votre point de vue sur ce sujet, je vous en serais très reconnaissant.

Sincèrement vôtre,

Wm. F. Zimmermann

New York, 19 septembre 1897 .

#46 et 48 E. Houston Str.

MCF Scott,

Westinghouse Electric Co.,

Pittsburgh, Pennsylvanie.

Mon cher M. Scott : -

J'ai lu dans les journaux électriques un article faisant référence à un gros moteur à induction

récemment installé à Niagara. N'auriez-vous pas la gentillesse de me donner quelques détails sur mon

informations personnelles.

Cordialement,

Société d'électricité et de fabrication Westinghouse

Pittsburg, Pennsylvanie, 23 septembre 1897.

SUJET – MOTEUR À INDUCTION.

M. Nickola Tesla

46-48 E. Houston St.,

La ville de New York .

Mon cher M. Tesla : -

En réponse à votre note demandant des données concernant un gros moteur à induction, j'ai plaisir à vous envoyer plusieurs photographies et un dessin d'encombrement donnant les dimensions.

L'enroulement primaire est constitué de bobines de fines bandes de cuivre. Le moteur démarre en appliquant une basse tension reçue via des transformateurs. Le courant de ligne pour démarrer à la moitié du couple à pleine charge est à peu près égal au courant normal à pleine charge, et le couple de démarrage peut être augmenté avec une augmentation correspondante du courant de ligne. Le couple d'extraction est cinq ou six fois supérieur au couple normal à pleine charge. Le facteur de puissance à mi-charge est de 91 % et à pleine charge de 96 %. Le rendement est de 90 % à demi-charge et de 91 % à pleine charge.

Le moteur a une vitesse à vide de 375 tours. lors d'un fonctionnement sur un circuit à 3000 alternances et le glissement à pleine charge est d'environ 3 %. La tension normale sur chacune des deux phases est de 2 200 volts. L'augmentation maximale de la température lors du transport de 500 CV est d'environ 30 degrés C. Le moteur peut facilement transporter 500 CV, mais sa puissance nominale est de 400 CV car le contrat sous lequel il a été vendu prévoit une capacité de surcharge considérable. Deux de ces moteurs ont été fabriqués, dont le premier fonctionne avec succès dans la station d'éclairage de Niagara Falls, entraînant les dynamos de la station depuis environ un mois.

C'est, je crois, la plus grande évolution des moteurs à induction sur lesquels nous avons travaillé avec tant d'énergie il y a plusieurs années.

Sincèrement vôtre,

SFC

CF Scott

CHEF ÉLECTRICIEN

New York, 24 septembre 1897 .

#46 et 48 E. Houston Str.

MCF Scott,

Westinghouse Electric Co.,

Pittsburgh, Pennsylvanie.

Mon cher M. Scott : -

J'ai reçu votre aimable lettre du 23 septembre accompagnée des photographies et

dessin du moteur de 400 CV. Votre précieux document sur l'installation des chutes du Niagara est également parvenu

moi et moi l'avons parcouru avec intérêt.

Les résultats que vous donnez me paraissent remarquables, et j'y vois que vous n'avez pas arrêté

je travaille sur ces moteurs depuis que je les ai laissés entre vos mains.

Je considère ces résultats comme particulièrement précieux dans la mesure où ils montrent que les grandes machines de

ce type peut être construit et exploité avec succès.

En vous remerciant pour vos courtoisies, je suis,

Sincèrement vôtre,

New York, 15 octobre 1897 .

#46 et 48 E. Houston Str.

M. George Westinghouse, Jr.

Lenox, messe.

Cher M. Westinghouse : -

Je dois vous demander une faveur qui, je l'espère, sera conforme à votre intérêt à donner sans sacrifice indu.

Un représentant de mon associé Schneider & Co., du Creuset, France, M. Auguste Boissonnas, est ici et je lui ai remis une lettre officielle de présentation. Il s'intéresse principalement à développement de la traction électrique rapide, notamment en courants alternatifs et leur application à de tels utiliser pour la transmission longue distance, et j'entretiens la plus haute estime pour mes associés et je suis le plus soucieux d'entretenir des relations amicales avec eux, je vous prierais de faciliter à M. Boissonnas une inspection de vos admirables œuvres. Vous n'avez pas besoin de vous douter qu'un avantage sera pris, car ces gens sont de la plus haute position, et s'ils voulaient voir quelque chose, ce serait pour leur intérêt à acquérir, ils vous rencontreraient de manière fidèle.

M. Boissonnas, si je comprends bien, partira d'ici vendredi soir et pourrait être en Pittsburgh samedi ou en début de semaine prochaine. Vous m'obligeriez grandement si vous le faisiez par téléphone ou sinon, donnez des instructions pour qu'il soit reçu de manière amicale. Ce qui me tient le plus à cœur, c'est de montrer l'application étendue et réussie du système polyphasé à un certain nombre de fins.

En vous remerciant d'avance, je suis,

Sincèrement votre,

GEORGE WESTINGHOUSE.
PARC MOTEUR. LENOX, MASSE.

17 octobre 1897

M. Nicola Tesla,

46 et 48 rue Est Houston,

New York.

Cher M. Tesla :

Votre lettre du 15 m'est parvenue entre les mains hier, peu après quatre heures, à mon arrivée de Boston.

Je télégraphie simplement à MBH Warren, vice-président de la société, ce qui suit :

"M. Tesla souhaite que nous donnions à M. Auguste Boissonas, de Schneider and Co.,

Paris, l'occasion d'observer pleinement le fonctionnement des moteurs Tesla et de visionner

nos ateliers. Veuillez le voir vous-même et lui accorder les installations souhaitées. M. Tesla

s'attendait à ce qu'il soit à Pittsburgh samedi ou en début de semaine. Présentez M. Boissonas

à M. Keller et à mon frère.

Et je suis assuré que M. Boissonas aura l'opportunité souhaitée.

Vous remarquerez dans mon télégramme que j'ai demandé à M. Warren de présenter M. Boissonas au mont. Keller, de la Westinghouse Machine Company, où ils font un très bon travail

merveilleux moteur à essence, et à mon frère, M. HH Westinghouse, directeur de l'Air Brake Company.

Si M. Boissonas n'est pas déjà allé à Pittsburg, ne pourriez-vous pas sortir et passer une journée

et à moitié là avec lui ? Malheureusement, je risque d'être obligé de rester à l'Est toute la semaine prochaine.

Sincèrement votre,

Géo. Westinghouse

PS : Je serai dans mon bureau mardi.

Société d'électricité et de fabrication Westinghouse

Pittsburg, Pennsylvanie.

Bureau de Saint-Louis, bâtiment central américain

26 octobre 1897

N. Tesla, Esp.,

#46, rue East Houston,

La ville de New York.

Cher M. Tesla,

Votre ami, M. Auguste Hoissonnas, est venu me voir aujourd'hui et j'ai été bien désolé qu'il soit

je ne faisais que le traverser et je ne pouvais pas lui montrer les différentes choses qu'il voulait voir. Il espère arrêter

ici encore en revenant du Mexique, et je lui montrerai alors tout ce qu'il y a dans cette ville.

Sincèrement vôtre,

G Wataleon

Société d'électricité et de fabrication Westinghouse

Agence de Pittsburgh

Pittsburg, Pennsylvanie, 3 décembre 1897

Nikola Tesla, Esq.,

Hôtel Gerlach,

New York, New York

Ma chère Tesla : -

J'ai remarqué par les Pittsburg Papers que vous avez été malade, mais que vous êtes maintenant en convalescence, et je suppose

cette occasion pour vous féliciter de ce fait et espérer que vous resterez en meilleure santé que

aussi longtemps que vous le souhaitez.

Toujours, sincèrement,

EH Heinrich

New York, le 4 décembre 1897 .

#46 et 48 E. Houston Str.

M. George Westinghouse, Jr.,

120 Broadway,

La ville de New York.

Cher M. Westinghouse : -

Ci-joint une lettre que je viens de recevoir d'Angleterre et qui pourrait vous intéresser. Veuillez le retourner après lecture.

J'écrirai à ces parties pour communiquer avec vous à ce sujet.

Sincèrement vôtre,

GÉO. MAISON WESTING.

PITTSBURGH, Pennsylvanie.

7 décembre 1897 .

M. NIKOLA TESLA,

c/o Tesla Electric Co., New York.

Cher M. Tesla : -

J'ai votre faveur du 4 , ci-joint une lettre de Patterson, Cooper, & Co., dont je

en enverra une copie à notre maison de Londres. J'espère que cette question recevra une attention rapide, de la part de la mutuelle.

avantage de toutes les parties concernées.

Votre serviteur,

Géo. Westinghouse

New York, le 14 décembre 1897 .

#46 et 48 E. Houston Str.

M. EH Heinrichs,

Westinghouse Electric Co.,

Pittsburgh, Pennsylvanie.

Mon cher M. Heinrich : -

Merci pour la preuve de votre aimable intérêt.

Il est vrai que je ne me porte pas très bien ces derniers temps, mais je peux vous assurer que je me porte bien physiquement et

mentalement bien à l'heure actuelle. J'ai cependant encore un petit mal qu'on pourrait mieux qualifier de financier.

l'anémie dont vous souffrez vous-même, si je ne me trompe.

J'aimerais que tu te souviennes de moi auprès de tous les garçons vers Noël, car c'est tout à fait possible

que certains d'entre eux pourraient se sentir disposés à m'envoyer un gage.

Cordialement,

Société d'électricité et de fabrication Westinghouse.

Agence de Pittsburgh

Pittsburg, Pennsylvanie, 8 décembre 1897

Nikola Tesla, Esq.,

New York, New York

Mon cher M. Tesla : -

Un grand merci pour votre aimable faveur du 4 ème inst.

Même si je suis très heureux d'apprendre que vous êtes en parfaite condition physique et mentale, il

Cela me chagrine beaucoup de devoir vous informer que vous souffrez de ce que vous choisissez d'appeler des « problèmes financiers ».

anémie", mais, comme vous le dites, il y a une consolation à savoir que vous avez de nombreux camarades qui souffrent, votre

«humble serviteur», étant l'un d'entre eux.

Je me souviendrai de votre souhait de parler de vous aux garçons de Pittsburg et j'espère que certains d'entre eux

ils se sentiront disposés à vous envoyer un souvenir de Noël.

Avec mes meilleures salutations, toujours,

Cordialement,

Ernest H. Heinrich

Société d'électricité et de fabrication Westinghouse.

Agence de Pittsburgh

Pittsburg, Pennsylvanie, 3 janvier 1898

Compte.

M. Nikola Tesla,

#46, rue East Houston,

New York, New York

Cher Monsieur: -

Nous joignons ci-joint un relevé de votre compte à jour, accompagné de notre récépissé.

pour la même chose, et l'auteur est chargé par M. Westinghouse de dire que nous avons le plaisir d'envoyer

vous ce reçu et que ce faisant nous apprécions beaucoup le service que vous avez de temps en temps

nous a permis de recommander nos appareils, d'avoir des clients intéressés en notre nom et dans de nombreux

moyens d'aider matériellement les intérêts de notre Société.

Avec les meilleurs compliments de la saison, nous sommes

Sincèrement vôtre,

BH Warrell

Deuxième vice-président

BHW

Enceinte

New York, 6 février 1898

#46 et 48 E. Houston Str.

Westinghouse Electric & Mfg. Co.,

Pittsburgh, Pennsylvanie.

Messieurs: -

Je n'ai pas encore répondu à votre aimable lettre du 3 janvier , qui, avec déclaration ci-jointe, a été dûment reçue, parce que j'espérais quotidiennement que mes affaires m'amèneraient à Pittsburgh, où j'aurais eu l'occasion de vous remercier en personne pour votre traitement attentionné.

Bien que je ne puisse pas exactement partager votre point de vue sur la question, étant donné que la plus grande partie de votre appareil m'a été fournie sur la suggestion de M. Schmidt dans le but de faciliter des recherches plus approfondies dans le domaine de mon système de transmission de puissance polyphasée, j'apprécie néanmoins je vous remercie sincèrement de votre équité et vous prie de transmettre à M. Westinghouse mes remerciements ainsi que mes meilleurs vœux de réussite pour l'avenir.

J'ai pour principe, depuis que je me consacre à la recherche scientifique en laboratoire, de ne jamais accepter d'honoraires ou de compensations pour des services professionnels, et je ne pourrais profiter de votre offre si la plupart de vos machines n'étaient détruites par un incendie. J'aurais eu le devoir d'assurer l'appareil, et dans ce cas le montant vous serait intégralement restitué, mais comme il n'était pas assuré, je partage votre perte, puisque j'ai été privé des instruments qui sont nécessaires à l'entretien. la poursuite réussie de mes travaux dans la province dans laquelle, grâce à la prévoyance de M. Westinghouse, vous occupez aujourd'hui la position de leader.

Bien que, si je devais apprécier mes services, j'y accorderais une valeur beaucoup plus élevée que vous pourriez vous permettre de payer, je tiens à déclarer ici délibérément et explicitement que vous ne devriez pas vous sentir le moins du monde obligé envers moi pour tout ce que j'ai fait pour moi. vous, car je considérais que c'était justement votre dû et dans l'intérêt de mes amis et de ceux qui avaient confiance en mon opinion.

Croyez-moi,

Sincèrement vôtre,

New York, 27 février 1898

#46 et 48 E. Houston Str.

Karl Till, Esp.,

136 Ouest, 64 rue,

Ville de New York.

Mon cher monsieur: -

Pourriez-vous s'il vous plaît appeler dès que possible à mon bureau, à l'adresse ci-dessus. Il est possible que je

vous pourrez peut-être faire quelque chose à votre avantage.

Sincèrement vôtre,

New York, le 5 mars 1898

#46 et 48 E. Houston Str.

M. Charles Till,

Westinghouse Electric Co.,

East End Ave., Pittsburgh Pennsylvanie.

Mon cher monsieur: -

J'ai été très heureux d'apprendre par votre lettre du 3 mars , que je viens de recevoir, que mes amis du

Westinghouse Company a trouvé possible de vous donner un emploi. Quand tu es venu ici, j'ai parlé

à un ou deux amis à votre sujet, mais il y avait encore peu de perspectives pour un poste.

Je ne peux pas dire en toute conscience que je pourrais vous offrir quelque chose de mieux que ce que vous avez actuellement et

je vous conseillerais d'y rester. Si toutefois vous aviez de nouveau besoin d'un poste, vous pourrez faire appel à moi.

et je ferai de mon mieux pour vous placer.

Sincèrement vôtre,

New York, 27 mars 1898 .

#46 et 48 E. Houston Str.

M. George Westinghouse, Jr.,

120 Broadway,

La ville de New York.

Cher M. Westinghouse : -

Le Prince Albert de Belgique, lors d'une visite à mon laboratoire il y a une semaine, m'a dit

m'a dit qu'il avait l'intention de voir l'usine de Niagara. Je ne doute pas qu'il serait intéressé

inspecter vos Travaux ainsi qu'à vous rencontrer personnellement, sachant que vous êtes l'un des grands piliers

de l'industrie électrique de ce pays. Je suis poussé par l'intérêt que je ressens pour vous à vous demander si ou

vous ne lui adresseriez pas une telle invitation et, peut-être, lui offririez votre hospitalité lors de sa visite à

vos nombreux travaux et les chutes du Niagara. Ce n'est peut-être pas seulement une question de plaisir pour vous de le rencontrer, mais

ses connaissances personnelles peuvent également avoir une influence importante sur le développement de certains de vos

affaires étrangères, car il sera bientôt dans une position de grand pouvoir, étant l'héritier présomptif du

Trône belge. C'est un jeune homme très modeste et sans prétention qui semble rapidement se lier d'amitié.

Si vous jugez nécessaire de communiquer avec moi à ce sujet, votre lettre me trouvera

ici, même si ce n'est pas du tout nécessaire. Prince Albert était à Philadelphie hier et vous apprendrez

de ses déplacements ultérieurs par le consulat belge.

Cordialement,

GÉO. MAISON WESTING.

PITTSBURGH, Pennsylvanie.

30 mars 1898 .

M. Nikola Tesla,

New York.

Cher M. Tesla : -

Je vous remercie pour votre faveur du 27 . De Mars. Je constate que le Prince Albert de Belgique est

proposant de visiter l'usine de Niagara. Je ne sais pas exactement quoi faire pour l'inviter à

Pittsburgh. Des amis à Philadelphie m'ont appris qu'il faisait ses propres projets et j'ai refusé.

toute attention particulière. Je dois être à New York vendredi, et si vous êtes en ville entre deux et trois heures

heures, je serais heureux de vous voir à mon bureau, lorsque nous pourrons avoir une petite conversation à ce sujet.

Votre serviteur,

Géo. Westinghouse

New York, 10 mai 1898 .

#46 et 48, rue E. Houston

M. George Westinghouse, Jr.,

120 B'way, ville de New York.

Mon cher M. Westinghouse : -

Je suis informé par l'intermédiaire du Secrétaire de la Légation de Belgique que Son

Altesse le Prince Albert devrait être à Pittsburgh vers les 28 et 29 mai .

J'espère que ce moment vous conviendra. Le Prince Albert, je l'entends, est fortement pressé de

temps et ne pourra probablement pas rester à Pittsburgh plus de vingt-quatre heures. Cela pourrait vous plaire

d'apprendre qu'il s'est exprimé par l'intermédiaire du secrétaire de la manière la plus reconnaissante envers vous-même et

vos travaux. Même s'il n'a pas exactement déclaré qu'il accepterait votre hospitalité, je crois qu'il le fera.

profitera volontiers de l'occasion d'en savoir davantage sur l'homme, qui a tant contribué

une part importante au progrès électrique.

Si vous me faites savoir, dans les meilleurs délais, quoi répondre, je serai heureux de vous

transmettre votre message.

Cordialement,

Société d'électricité et de fabrication Westinghouse.

Pittsburg, Pennsylvanie.

17 mai 1898.

-N-

SUJET – EXPOSITION INTERNATIONALE DU TRANS-MISSISSIPPI.

M. Nikola Tesla,

#46 rue E. Houston,

La ville de New York.

Mon cher monsieur: -

Lors de la prochaine exposition internationale Trans-Mississippi, nous avons pris une part importante et

espace important et accordera une importance particulière à une exposition Tesla. Nous aurons des générateurs polyphasés

et des moteurs, et nous souhaitons ajouter à l'intérêt de l'exposition en plaçant les premiers appareils Tesla. Un grand

Une exposition en a été faite à l'Exposition universelle qui vous a ensuite été envoyée à New York. Il est possible que cela

Il a peut-être été perdu dans votre incendie, même s'il s'est peut-être échappé et est maintenant disponible. Nous

Je vous demande de nous laisser exposer autant de matériel que possible. Faites-nous savoir en ce qui concerne

l'affaire à un stade précoce puisque l'exposition s'ouvrira très prochainement.

Sincèrement votre,

WESTINGHOUSE ELECTRIC & M'FG CO.

SFC

LA Oscorne

ASS'T DU DEUXIÈME VICE-PRÉSIDENT

New York, le 18 mai 1898

#46 et 48 E. Houston Str.

Westinghouse Electric Co.,

Pittsburgh, Pennsylvanie.

Messieurs: -

Votre faveur du 17 mai , en ce qui concerne l'Exposition internationale Trans-Mississippi, a été reçu.

Même si je préférerais ne pas accorder une importance excessive à mon nom, je ferais néanmoins de mon mieux tout à fait pour répondre à votre souhait, si je pouvais le faire efficacement. Je n'ai pratiquement rien de convenable pour exposition au delà d'une grande bague que tu m'as transmise, qui est un de mes proches compagnons de laboratoire et dont je ne voudrais pas me séparer. Je suppose que les gens d'aujourd'hui s'intéresseront beaucoup plus à votre magnifique machinerie que dans ce premier appareil.

Croyez-moi,

Sincèrement vôtre,

New York, 26 avril 1896 .

#46 et 48 E. Houston Str.

M. George Westinghouse, Jr.,

Pittsburgh, Pennsylvanie.

Cher M. Westinghouse : -

Je prends la liberté de vous présenter ci-joint M. Friedrich Ross, qui en connecté avec certains de mes amis et associés en Allemagne. Il a hâte de voir votre admirable usine à Pittsburgh, et je vous serais très reconnaissant pour toute courtoisie qui lui serait accordée lors de son visite.

Avec merci je reste,

Cordialement,

New York, le 16 mai 1898 .

#46 et 48 E. Houston Str.

M. George Westinghouse, Jr.,

Pittsburgh, Pennsylvanie.

Cher M. Westinghouse : -

Votre lettre faisant référence à Prince Albert vient d'être reçue.

J'ai écrit au Consul de Belgique et lui ai suggéré de transmettre les vœux de le Prince à vous directement.

Croyez-moi,

Sincèrement vôtre,

GÉO. MAISON WESTING.

PITTSBURGH, Pennsylvanie.

#120 Broadway, New York, État de New York,

19 mai 1898 .

Nikola Tesla, Esq.,

#46, rue East Houston, ville.

Cher M. Tesla : -

Je viens d'arriver à New York et je trouve votre lettre du 16 janvier . J'ai reçu une lettre du Vice-Consul de Belgique M. Mali disant qu'il a envoyé la lettre que je vous ai écrite au Conseiller Joostens à l'Auditorium Hotel de Chicago.

J'ai eu une conférence avec le ministre belge et j'ai en conséquence écrit formellement à Le conseiller Joosten a invité le prince et son groupe à être nos invités et ceux de Mme. Westinghouse à Pittsburg, et j'ai organisé une tournée d'inspection qui, j'espère, sera satisfaisante pour eux.

En vous remerciant pour vos lettres, je suis,

Sincèrement votre,

Géo. Westinghouse

PS : je pars ce soir pour Lenox avec l'espoir d'être de retour ici samedi matin et repart à une heure pour Washington.

PPS Je viens de recevoir un télégramme du Conseiller Joostens acceptant l'invitation de Mme. Westinghouse et moi-même.

Société d'électricité et de fabrication Westinghouse.

Pittsburg, Pennsylvanie.

-A- 12 octobre 1898

Monsieur Nicola Tesla,

La ville de New York, New York

Cher Monsieur: -

Votre télégramme du 12 octobre adressé à M. Means m'a été renvoyé.

L'homme dont vous parlez est probablement M. Haardt, qui est venu nous voir en décembre dernier. Je viens de lui en parler et il doute qu'il souhaite occuper ce poste.

Je vous demanderais de bien vouloir m'informer de la nature du travail requis et si M. Haardt souhaite accepter le poste, nous serons heureux de vous le laisser. Sinon, je verrai si nous pouvons recommander un autre candidat.

Sincèrement vôtre,

OSL - Jr / G OS Lyford jr.

Ingénieur en chef.

PS

Je viens de vous télégraphier ce qui suit : « Cela signifie pas avec cette société. A écrit."

OSL - Jr.

New York, 12 octobre 1898

#46 et 48 E. Houson Str.

Westinghose Electric Mfg. Co.,

Pittsburgh, Pennsylvanie.

Messieurs: -

Je tiens à vous remercier pour votre réponse courtoise à ma dépêche d'aujourd'hui à M. Means. C'était

avec regret d'avoir appris qu'il avait quitté votre emploi, et j'espère que vous m'excuserez de vous déranger

sans le savoir avec l'affaire.

C'est à vous de m'expliquer que je me suis renseigné sur M. Haardt, qui m'a écrit il y a quelque temps :

postuler pour un poste chez moi. M. Haardt est venu dans ce pays pour un court séjour et il a été

recommandé par mon professeur Bertel de l'Ecole Polytechnique de Gratz. j'ai très envie de

obligez mon professeur et renseignez-vous sur M. Haardt en vue de lui donner l'emploi qu'il cherchait

pour. Bien entendu, tout était soumis à l’approbation de M. Means.

Sincèrement vôtre,

Pittsburg, Pennsylvanie. East End Ave. – 16 novembre – 98.

M. Nikola Tesla

New York

46 – 48 – rue E. Houston.

Cher Monsieur. –

En vous remerciant pour votre aimable lettre du 8 . Je dois dire que des circonstances privées ont fait que mon

départ d'ici nécessaire et avec votre aimable autorisation, je vous informerai de ma localisation à

le futur proche.

Respectueusement vôtre,

Charles Quint jusqu'à

NEW YORK., 29 novembre 1898 .

#46 et 48, rue E. Houston.

M. George Westinghouse, Jr.,

120 Broadway,

Ville de New York.

Cher M. Westinghouse : -

En raison de dépenses imprévues, je suis obligé de vous demander par l'intermédiaire de votre aimable

intervention, que j'espère que vous accorderez, à votre Compagnie un prêt de 6,000$. Je rendrai l'argent dans les délais

trois mois.

Comme je ne dois d'argent à personne, mes biens, bien que petits, constitueraient une garantie suffisante pour

ce montant, mais afin d'éviter une perte possible pour votre entreprise, je souhaite engager par la présente mon

droits aux redevances anglaises.

Vous assurer que votre gentillesse personnelle ainsi que le traitement attentionné de votre entreprise

ne sera pas oublié, je reste,

Cordialement,

GÉO. MAISON WESTING.

PITTSBURGH, Pennsylvanie.

#120 Broadway, New York, État de New York

29 novembre 1898

N. Tesla, Esq.,

#46 et 48 E. Houston St., ville.

Cher Docteur Tesla : -

Je viens de recevoir votre lettre et je suis heureux de vous dire que le L'entreprise vous prêtera les 6 000 $ selon les termes de votre lettre. Vous ferez gentiment appel Mr.Ph.Ferd.Kobbe Trésorier de la Société entre deux et trois heures demain et il arrangez les détails avec vous.

Sincèrement,

Géo. Westinghouse

New York, 30 novembre 1898 .

#46 et 48 E. Houston Str.

M. Géo. Westinghouse, Jr.,

120 Broadway,

La ville de New York.

Cher Westinghouse : -

Prenant acte de votre aimable lettre du même jour, je souhaite à nouveau exprimer mes remerciements

pour votre disponibilité à m'aider en la matière, que j'ai apprécié autant que le service lui-même.

Sincèrement vôtre,

GÉO. MAISON WESTING.

PITTSBURGH, Pennsylvanie.

New York, le 1
er décembre . 1898.

Dr Nikola Tesla,

46 et 48 E. rue Houston,

New York.

Cher Docteur Tesla : -

Après votre départ hier, j'ai décidé de vous écrire sans perdre de temps au sujet de votre appareil pour commuter le courant alternatif en courant continu. À l'heure actuelle, il y a une grande utilité pour quelque chose de ce genre, j'aimerais savoir si vous avez suffisamment avancé avec vos brevets et expériences pour être désormais en mesure de laisser Westinghouse Electric & Mfg.Co. entreprendre le fabrication de tels appareils à des conditions raisonnables. Vous apprécierez bien sûr le particulier Il serait avantageux pour vous personnellement de voir un appareil aussi important mis sur le marché par le Compagnie Westinghouse. Pouvez-vous me dire quelle est la taille d'un appareil que vous avez réalisé ? et combien de CV d'énergie qu'un tel appareil va transformer ? Et j'aimerais connaître les tensions avec lesquelles vous l'avez fait fonctionner avec jusqu'à présent.

Votre serviteur,

Géo. Westinghouse

New York, le 5 décembre 1898 .

#46 et 48 E. Houston Str.

M. Géo. Westinghouse, Jr.,

120 Broadway,

La ville de New York.

Cher M. Westinghouse : -

Je ne me sens pas assez bien depuis deux ou trois jours pour assister à mon correspondance, sinon votre aimable lettre du 1er décembre aurait reçu une réponse immédiate.

Je tiens à vous dire, en réponse à votre demande, que j'ai consacré beaucoup plus de temps à ce projet.

sujet auquel vous auriez pu penser. Je n'ai pas un, mais un certain nombre d'appareils que je propose d'installer

vos circuits, et pour chacun d'eux il y a une grande demande. Dès que j'aurai terminé un arrangement d'un intérêt vital pour moi qui, je l'espère, se déroulera dans deux ou trois semaines, je sera en mesure de vous contacter à ce sujet. Vous pouvez me croire, je ferai de mon mieux efforts pour promouvoir vos intérêts tout en favorisant les miens.

Cordialement,

GÉO. MAISON WESTING.

PITTSBURGH, Pennsylvanie.

New York,
8 décembre 1898 .

M. Nikola Tesla,

La ville de New York.

Cher Docteur Tesla : -

Je viens de rentrer de Pittsburgh et je trouve votre lettre du 5 décembre .

Une question qui me tient à cœur en ce moment est la question d'un appareil simple et économique pour

conversion des courants alternatifs en courants continus, et j'espère que vous m'en informerez avec le plus de précision possible

le moins de retard possible. En attendant, j'espère que vous terminerez rapidement les arrangements qui

vous dites qu'elles sont d'un intérêt vital pour vous.

Votre serviteur,

Géo. Westinghouse.

New York, le 12 décembre 1898 .

#46 et 48 E. Houston Str.

M. Géo. Westinghouse, Jr.,

Pittsburgh, Pennsylvanie.

Cher M. Westinghouse : -

Bien que votre aimable lettre du 8 décembre n'exige pas de réponse immédiate, je

Je tiens à vous assurer que je ne fais aucun effort pour mettre cet appareil sur le marché le plus rapidement possible. je

suis convaincu que les arrangements auxquels j'ai fait référence dans ma dernière lettre seront achevés

bientôt, lorsque j'aurai l'assurance de l'effet des hommes qui ne fait aucun doute.

En attendant, j'espère le plus sincèrement que mes travaux aboutiront à un résultat personnel.

avantage pour vous.

Cordialement,

Société d'électricité et de fabrication Westinghouse.

120 BROADWAY,

NEW YORK, NY , 21 février 1899 .

Nicola Tesla, Esq.,

#46, rue East Houston, ville.

Cher Monsieur: -

Nous vous rappelons que votre note pour

6 000,00 $

+ Intérêt. 90.00

Total 6 090,00 $

Est payable à ce bureau le 28 février 1899 .

Veuillez avoir des fonds ici à temps pour y répondre et ainsi obliger,

Votre serviteur,

GW Hébord

Vice-président par intérim.

New York, 24 février 1899

#46 et 48 E. Houston Str.

Westinghouse Elec. & Fabricant Co.,

120 Broadway,

La ville de New York.

Messieurs: -

Votre rappel très catégorique du 21 février a été dûment reçu, et à l'exception de cela est prématuré, inutile et plutôt laconique dans son expression, et implique une erreur en supposant que j'oubliais les tâches assumées, cela a été apprécié et approuvé comme un effort pour décourager l'habitude répréhensible d'emprunter de l'argent.

Il y a bien longtemps, j'aurais eu le plaisir de faire appel à vous au sujet de l'agréable raison de notre dernière rencontre, si je n'avais pas été engagé depuis lors dans des recherches psychologiques, auxquelles le les récentes déclarations de mon illustre ami, Sir William Crookes, m'ont incité à le faire. je suis en désaccord avec lui et d'autres philosophes quant à l'origine des états mentaux et à la transmission des efforts de l'esprit. Selon moi, il n'existe aucun état mental qui ne soit le résultat direct d'un état physique. impressions, il ne peut y avoir aucune influence des efforts mentaux à distance. Cette expérience très avec vous m'avez fourni une illustration frappante de la vérité de mes affirmations. L'autre jour, j'ai rêvé que je reçu de vous un chèque de cinquante mille dollars, inclus dans une lettre dont je ne peux maintenant, souviens-toi exactement. Je pense cependant que vous avez déclaré que cette somme n'était qu'une petite compensation pour services que je vous rendais depuis plusieurs années. Je me souviens très bien que, entre autres, vous me parlait d'aller voir tous mes amis riches et de susciter leur intérêt en votre nom à un moment où vous étiez dans l'adversité, et à mon grand secours en relation avec vos entreprises à Niagara, Masséna

et bien d'autres endroits, et si je ne me trompe pas, à en juger par vos déclarations, vous sembliez en fait

accablé, pour ne pas dire affligé, comme le montant de ma dette.

Maintenant, au réveil, je me mis à rechercher l'origine de ce rêve singulier, qui me donna beaucoup

plaisir pendant un moment, et après avoir soigneusement examiné toutes les vieilles étagères de ma mémoire, j'ai satisfait

moi-même que, conformément à mes vues, chaque détail de ce rêve était suggéré par

événements qui s'étaient réellement produits. Naturellement, j'étais très intéressé de voir où se trouvait la vérité.

à la doctrine de la transmission de la pensée, que mon illustre ami et certains de ses disciples

proposant. Bien entendu, même si je suis d'un avis contraire, je ne peux ignorer les points de vue de personnalités aussi haut placées.

autorités, et mon intérêt s'est naturellement accru jusqu'à l'excitation à l' approche du 28 février .

J'étais à peu près à la hauteur de mes attentes, lorsque votre faveur appréciée du 21ème instant, avant

mentionné, m'est parvenu. Son contenu ne laissait aucun doute dans mon esprit, à savoir qu'il n'y avait aucune pensée

transmission dans ce cas, et j'ai été encore renforcé dans mon opinion que l'interaction et

l'équivalence des efforts, que Spencer propose avec tant d'éloquence dans ses « Premiers principes » et qui

s'appliquent littéralement au monde matériel, ne s'appliquent pas aux états mentaux.

La reconnaissance de ces vérités importantes et l'unification des différents corollaires et

les déductions qui en découlent, conduiront forcément à la fondation d'un nouveau système de philosophie,

extrêmement matérialiste dans ses aspects généraux et ses caractéristiques, mais très utile à tous les

fins, lorsqu'il est soigneusement compris et rigoureusement appliqué dans toutes les transactions et relations avec nos

semblables. La croyance actuelle dans la restauration intégrale des efforts non démontrables par des moyens matériels

preuves, qui ont jusqu'à présent souvent constitué la base d'ententes et d'accords verbaux

grandement à l'avantage de ceux dont l'épiderme est développé à un degré d'épaisseur si inhabituel,

qui est propre à une certaine classe d'animaux bas, communément appelés crocodiles – va progressivement

disparaîtra et sera finalement réservé aux individus qui ont une prédisposition naturelle au

non-satisfaction de leurs objets et de leurs désirs dans les diverses activités de la vie. Cela deviendra un absolu

nécessité de promouvoir les intérêts du monde et de maintenir des relations amicales et harmonieuses

d'établir au préalable des équivalents exacts, matériels et tangibles à l'ensemble de nos efforts et performances,

et il sera bientôt reconnu qu'une stricte observance de ces principes contribuera à un grand

le succès, tandis que les ignorer entraînera tôt ou tard un échec désastreux.

M'excusant que, sous le charme de ces pensées, j'ai oublié de m'attarder longuement sur

ce sujet, ne vous intéressant peut-être pas, et attirant votre attention sur le chèque ci-joint au montant de 6090,00$,

dont vous m'obligerez en accusant réception, je reste, avec remerciements,

Votre serviteur,

Enceinte.

Westinghouse Electric & Manufacturing Company,

120 BROADWAY, NEW YORK, NY , 27 février 1899.

Nikola Tesla, Esq.,

#46, rue East Houston, ville.

Cher Monsieur: -

Nous devons accuser réception du vôtre du 24 janvier . en joignant votre chèque pour 6 090,00 $ pour retirer votre billet dû le 28 février .

Nous vous renvoyons donc ci-joint votre note du 30 novembre 1898 : Votre lettre du 30 novembre adressé à la société Tesla, et votre reçu de la même date, qui, nous l'espérons, vous parviendront sans encombre.

Votre serviteur,

GW Hébord

Vice-président par intérim

Enc.

GÉO. MAISON WESTING.

PITTSBURGH, Pennsylvanie.

New York,
le 20 avril . 1899.

Cher M. Tesla :

J'étais désolé de ne pas vous voir quand vous étiez là, mais mes fiançailles étaient telles que je pouvais

pas venu du Club pour vous voir. Cette lettre vous sera remise par M. Mershon, qui sait tout

sur l'éclairage électrique et l'énergie électrique dans et autour de Pike's Peak, ayant été liés au

Compagnie d'énergie électrique du Colorado. J'ai demandé à M. Mershon de vous donner toutes les informations dans son

pouvoir, et s'il y a quelque chose d'autre qui peut être fait, de quelque manière que ce soit ou des lettres sur autrement, je serai

heureux de rendre toute aide possible.

Sincèrement votre,

Géo. Westinghouse

Nikola Tesla, esq :

46, rue Est de Houston . ,

New York.

New York, le 22 janvier 1900 .

46 et 48 rue Hoston Est .

M. George Westinghouse, Jr.,

Pittsburgh, Pennsylvanie.

Cher Westinghouse,

Veuillez recevoir la communication suivante à titre personnel. je reviens tout juste de

Colorado, où je mène des expériences depuis quelques mois. Le succès a

été encore plus grand que ce à quoi je m'attendais, et entre autres choses, j'ai absolument démontré le

praticabilité de l'établissement d'une communication télégraphique vers n'importe quel point du globe à l'aide

des machines que j'ai perfectionnées. En réalisant le plan, je souhaiterai un moteur à connexion directe et

dynamo d'au moins trois cents chevaux, mais de préférence davantage, de part et d'autre de l'Atlantique, et

car cela entraînerait des coûts considérables qui, compte tenu de l'apparente impossibilité du

problème, et aussi à cause d'un sentiment de panique tout autour, j'ai peur d'avoir du mal à sécuriser, j'aimerais

pour vous demander si vous ne me rencontreriez pas à des conditions équitables pour me fournir les machines,

en conservant la propriété et en vous intéressant dans une certaine mesure d'une manière que je ne peux pas

pourtant clairement précisées, mais qui pourraient être trouvées après un échange mutuel d'idées sur le sujet. Je suis

naturellement motivé par l'intérêt personnel à faire cette proposition, mais vous pouvez me croire que, derrière elle,

il y a aussi un désir sincère de faire avancer les nôtres. Les démonstrations que j'ai faites au Colorado

sont de nature telle qu'ils excluent la possibilité d'un échec, et les performances du

Les machines que j'ai développées sont d'une telle nature qu'elles dépassent presque toute croyance. Vous saurez, de

bien sûr, que j'envisage l'établissement d'une telle communication simplement comme une première étape vers

et des travaux plus importants, à savoir celui du transport de l'énergie, mais comme ce dernier sera une entreprise sur

à une échelle beaucoup plus grande et plus coûteuse, je suis obligé de démontrer d'abord une fonctionnalité pour obtenir le

confiance du capital.

Je suis obligé d'accompagner cette proposition d'une demande à laquelle vous m'obligerez grandement en

s'y conformer sans trop tarder. J'ai été très enthousiasmé par les résultats obtenus et j'ai

j'ai travaillé avec une telle passion, que j'ai négligé de prendre les dispositions nécessaires pour obtenir de l'argent.

été dicté par la prudence, et à mon retour je m'aperçois que je devrai peut-être effectuer quelques paiements avant

certains fonds, qui me sont dus, pourront me parvenir. Etant ainsi obligé d'emprunter de l'argent, je me tourne vers

vous demander si votre entreprise ne m'avancera pas, disons 6 000 $, sur la garantie de mes droits de redevances

pour l'Angleterre, ou, si c'était préférable, s'ils n'achèteraient pas purement et simplement mes droits sur la redevance pour une somme de

10 000 $. Je préférerais emprunter de l'argent et payer les intérêts, car je ne suis pas sûr de devoir vendre

ma part, qui est les quatre neuvièmes du total environ dû à ma Société, ne sachant pas exactement si, en

ce faisant, je pourrais nuire aux intérêts de mes associés, M. Brown et Mme Peck. Nécessitant cependant le

de l'argent et pensant que mon droit entre vos mains augmenterait, au contraire, la valeur de leur part,

puisque cela donnerait à votre entreprise une raison supplémentaire pour faire avancer ses affaires, j'ai osé faire ceci

suggestion. Quoi qu'il en soit, j'espère que vous pourrez m'envoyer un chèque d'ici un jour ou deux, le

quelles que soient les conditions que vous préférez. Je serai certainement très reconnaissant pour le service.

Je ne cache pas avoir besoin d'argent, mais en ce qui concerne le plan de transmission des messages, je

je ne voudrais pas encore être connu avant que certains de mes brevets, qui sont autorisés, n'aient été délivrés.

Cordialement,

PROTOCOLE D'ACCORD : conclu et conclu ce dixième jour d'avril mille neuf cents, entre Nikola Tesla, de la ville, du comté et de l'État de New York, et la Westinghouse Electric and Manufacturing Company, une société organisée et existant sous le lois de l'État de Pennsylvanie, TÉMOIN :

ATTENDU QUE la société Tesla Electric a conclu un accord avec la Westinghouse Electric Company, Limited, portant la date du 22 mai 1896, par lequel est vendu, cédé, transféré et remis à ladite Westinghouse Electric Company, Limited, tous ses droits en vertu des lettres patentes de la Grande-Bretagne et de certaines colonies britanniques sur les inventions de Nikola Tesla, relatives à la transmission électrique et à l'application d'énergie par courants alternatifs, telles qu'énumérées dans « l'Annexe A », jointe audit accord, ainsi que tous ses droits sur le renouvellement, réémission ou prolongations desdites lettres patentes, ou de l'une d'entre elles, et tous les droits pour la Grande-Bretagne et les colonies britanniques sur les améliorations apportées jusqu'ici ou qui pourraient par la suite être apportées par Nikola Tesla, dans le système de transport ou de distribution d'énergie par courants alternatifs couverts par lesdits brevets, ou l'un d'entre eux, ou les appareils, machines, appareils ou dispositifs connectés à ceux-ci : et,

ATTENDU QUE ladite Westinghouse Electric Company, Limited, en considération des droits conférés ci-dessus, a accepté, entre autres choses, de payer à ladite Tesla Electric Company, un quart de toutes les redevances qu'elle pourrait recevoir des licences en vertu desdits brevets ou l'un d'entre eux, à titre de dommages-intérêts pour violation desdits brevets, ainsi que des redevances égales à vingt-cinq pour cent du taux moyen auquel d'autres fabricants paient des redevances à ladite Tesla Electric Company, pour l'utilisation desdits brevets pour tous les appareils qui ladite Westinghouse Electric Company, Limited, pourrait elle-même fabriquer et vendre sous la protection desdits brevets après la date dudit accord ; et,

ATTENDU QUE ledit Nikola Tesla désire maintenant vendre et céder son intérêt sur les redevances à payer en vertu dudit accord du 22 mai 1896 à la Westinghouse Electric and Manufacturing Company :

MAINTENANT, en contrepartie du retour audit Nikola Tesla, de sa note à la Westinghouse Electric and Manufacturing Company, pour six mille dollars (6 000 $) avec intérêts, datée du 30 janvier 1900, et la somme supplémentaire de quatre mille dollars (4 000 $).) payé lors de la passation et de la remise du présent accord, audit Nikola Tesla, par la Westinghouse Electric and Manufacturing Company, tous lesdits intérêts que lui, ses héritiers ou ayants droit peuvent avoir dans les redevances qui pourraient être dues à la Tesla Electric Company , aux termes de l'accord du 22 mai 1896.

EN FOI DE QUOI : nous avons fait exécuter les présentes aux jour et année indiqués ci-dessus.

Nikola Tesla

TÉMOINS :Charles A. Terry –
Secrétaire.

ÉTAT DE NEW YORK :
:ss -
COMTÉ DE NEW YORK :

Ce dixième jour d'avril de l'an mille neuf cents, devant moi se présenta personnellement Nikola Tesla, que je connais et que je connaissais comme étant l'une des parties décrites dans et qui exécutèrent l'instrument ci-dessus, et il me reconnut qu'il a exécuté la même chose.

HM Capel
Notaire Public, Comté de NY,

ÉTAT DE NEW YORK : :ss-COMTÉ DE NEW YORK :

Ce dixième jour d'avril de l'an mille neuf cents, devant moi est venu personnellement Charles A. Terry, que je connais, qui, dûment assermenté, a déposé et a déclaré qu'il résidait à New York ; qu'il est le secrétaire de la Westinghouse Electric and Manufacturing Company, la société décrite et qui a signé l'instrument ci-dessus ; qu'il connaissait le sceau de ladite corporation; que le sceau apposé sur ledit instrument était ce sceau corporatif ; qu'il a été ainsi apposé par ordre du conseil d'administration de ladite corporation, et qu'il y a signé de son nom par même ordre.

HM Capel,
notaire du
comté de New York, New York

New York, 10 avril 1900.

Westinghouse Electric and Manufacturing Company,
120 Broadway, New York, New York.

Messieurs: --

Faisant référence à l'accord conclu ce jour concernant ma part des redevances qui sera payé par la Westinghouse Electric Company, Limited, à la Tesla Electric Company : je garantis que je le fais n'avons conclu aucun accord ou engagement avec qui que ce soit qui puisse interférer de quelque manière que ce soit avec le paiement des quatre neuvièmes des redevances conformément au présent accord, et je le ferai, si nécessaire, obtenir tout autre consentement des autres parties intéressées par Tesla Electric Company.

Votre serviteur,

GÉO. MAISON WESTING.

PITTSBURGH, Pennsylvanie.

120 Broadway, New York,

5 septembre 1900.

Cher Docteur Tesla :

A mon arrivée à New York ce matin, je trouve votre lettre du 30 août , pour laquelle je remercie

vous très sincèrement. Je pense que nous devons tous les deux être félicités pour l'issue du procès : vous, parce que

les Tribunaux vous ont accordé le mérite d'une grande invention ; et nous, parce que nous sommes susceptibles de

faire respecter nos droits afin que nous puissions bénéficier de certains avantages dus aux dépenses importantes que nous

avez apporté dans le développement commercial de vos inventions.

Vous savez que j'apprécie votre intérêt sympathique pour mes affaires.

Crois-moi,

Très sincèrement vôtre,

Géo. Westinghouse

New York, le 13 mars 1901 .

46 et 48 rue East Houston.

M. Géo. Westinghouse, Jr.,

120 Broadway, New York.

Cher M. Westinghouse : -

Conformément à notre conversation d'aujourd'hui, je tiens à dire que j'espère avoir le plaisir de vous voir à Pittsburgh mardi prochain. Il serait préférable, dans ces circonstances, de reporter une étape supplémentaire jusqu'à ce moment-là.

Avec mes remerciements pour votre courtoisie, je reste,

Sincèrement vôtre,

GÉO. MAISON WESTING.

PITTSBURGH, Pennsylvanie.

New York, le 18 mars 1901 .

Nikola Tesla, Esq,

46 et 48 rue East Houston,

New York.

Cher M. Tesla :

J'ai dûment reçu votre lettre disant que vous seriez à Pittsburgh mardi conformément avec notre conversation. Je trouve que des affaires importantes me retiendront à New York jusqu'à mardi.

nuit, et j'espère donc qu'il sera tout à fait pratique pour vous d'être à Pittsburg mercredi.

Je compte maintenant prendre le train quittant Jersey City à 20 h 44 demain, et si ce train sera une solution qui vous convient, je serais heureux que vous m'accompagniez dans ma voiture, qui, après demande, vous

trouvera facilement dans cette station.

Si cela vous convient, veuillez venir à Jersey City vers 19h30 afin de pouvoir dîner.

avec nous dans la voiture.

Sincèrement,

Géo. Westinghouse

COPIE.

Waldorf-Astoria

New York. 11 janvier 1906.

George Westinghouse, Esq.,

120 B'way ., New York.

Mon cher M. Westinghouse :

Est-il arrivé quelque chose qui ait gâché la cordialité de nos relations ? Je serais vraiment désolé non seulement

à cause de mon admiration pour toi mais pour d'autres raisons sérieuses.

La transmission d'énergie sans fil créera très bientôt une révolution industrielle et ainsi de suite.

comme le monde n’en a jamais vu auparavant. Qui doit être utile dans ce grand développement et qui en tirera

en retire-t -il de plus grands avantages que vous-même ?

S'il vous plaît, soyez attentif dans vos contacts avec les autres - et non à mon intérêt personnel, car cela n'a que peu d'importance.

conséquence - mais de ce travail très avancé, maintenant au stade délicat d'une pousse. C'est facile à détruire

et difficile de réussir.

Je ne demande aucune faveur mais j'aimerais sentir que vous avez pour moi la même haute estime que vous

l'ont toujours montré.

Sincèrement vôtre,

165 Broadway, New York.
21 novembre 1908.

M. George Westinghouse,

165 Broadway,

La ville de New York.

Cher M. Westinghouse : --

J'ai lu avec grand plaisir dans les journaux de ce matin le succès de votre plan de re-

organisation.

La force d'un homme se manifeste dans l'adversité. Vous avez surmonté des obstacles qui semblaient

insurmontable et montrez une fois de plus que vous faites partie de ceux qui ne peuvent pas être abattus. Veuillez accepter mon

Sincères félicitations.

Cordialement votre,

GÉO. MAISON WESTING.

PITTSBURGH PA.

24 novembre 1908.

Cher M. Tesla :

Un grand merci pour votre lettre du 21 novembre . Il reste encore beaucoup à faire avant que mes affaires s'installent.

Je vous remercie sincèrement pour vos chaleureuses félicitations.

Sincèrement,

Géo. Westinghouse

Nikola Tesla, Esq.,

165 Broadway,

La ville de New York.

165 Broadway, New York.
4 juin 1910.

Cher M. Westinghouse : -

Mon ami Brishane écrit beaucoup d'éditoriaux pourris mais c'est un génie et quand il frappe

le bon sujet, il le fait bien. Le ci-joint en fait partie.

Cordialement,

George Westinghouse, Esq.,

165 Broadway, New York.

Enceinte.

165 Broadway, New York.

10 août 1910 .

Cher M. Westinghouse :

Je suppose que vous ne pouvez pas vous empêcher d'être déçu par l'ingratitude de certains qui sont maintenant

diriger la grande entreprise que votre génie a créée, mais les déclarations telles que celles ci-jointes peuvent

vous apporter une certaine consolation.

Avec des expressions de haute estime, croyez-moi,

Très sincèrement,

George Westinghouse, Esq.,

165 Broadway, New York.

enceinte.

GÉO. WESTINGHOUSE

PITTSBURGH, Pennsylvanie.

15 août 1910.

Cher M. Tesla :

Un grand merci pour votre lettre du 10 août avec sa pièce jointe de l'Evening Mail,

que j'avais déjà vu. Je suis sûr que vous vivrez assez longtemps pour constater un grand changement dans le sentiment des

public à l'égard de ce qui pourrait s'avérer n'être qu'un revers temporaire.

Avec mes remerciements pour votre lettre, je suis,

Sincèrement votre,

Géo. Westinghouse

M. N. Tesla,

165 Broadway,

New York.

165 Broadway, New York.

19 août 1910.

Cher M. Westinghouse :

Accusant réception de votre aimable lettre du 15 . J'espère sincèrement que vous le ferez très

retrouvera bientôt la position que vous avez occupée jusqu'ici à l'égard des grandes industries.

qui possèdent leur existence grâce à vos efforts infatigables. Je suis sûr qu'une grande majorité du public est

entièrement en sympathie avec vous.

Crois-moi,

Cordialement votre,

George Westinghouse, Esq.,

Pittsburgh, Pennsylvanie.

CERCLE DUPONT,

WASHINGTON DC

Hôtel à Windsor

New York 28 décembre

Cher M. Tesla

Votre lettre très attentionnée a touché Mme Westinghouse et moi-même très profondément.

J'avais parlé de toi à ma mère et j'espérais que tu nous rendes visite pour qu'elle puisse te voir et maintenant je ne pourrai plus jamais

être. Nous vous remercions sincèrement pour vos paroles de sympathie et espérons que vous pourrez passer une nouvelle année en bonne santé et

beaucoup de bonheur.

Cordialement,

Géo Westinghouse